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LECTURES

BY THE

Rev. Jos. Cook.

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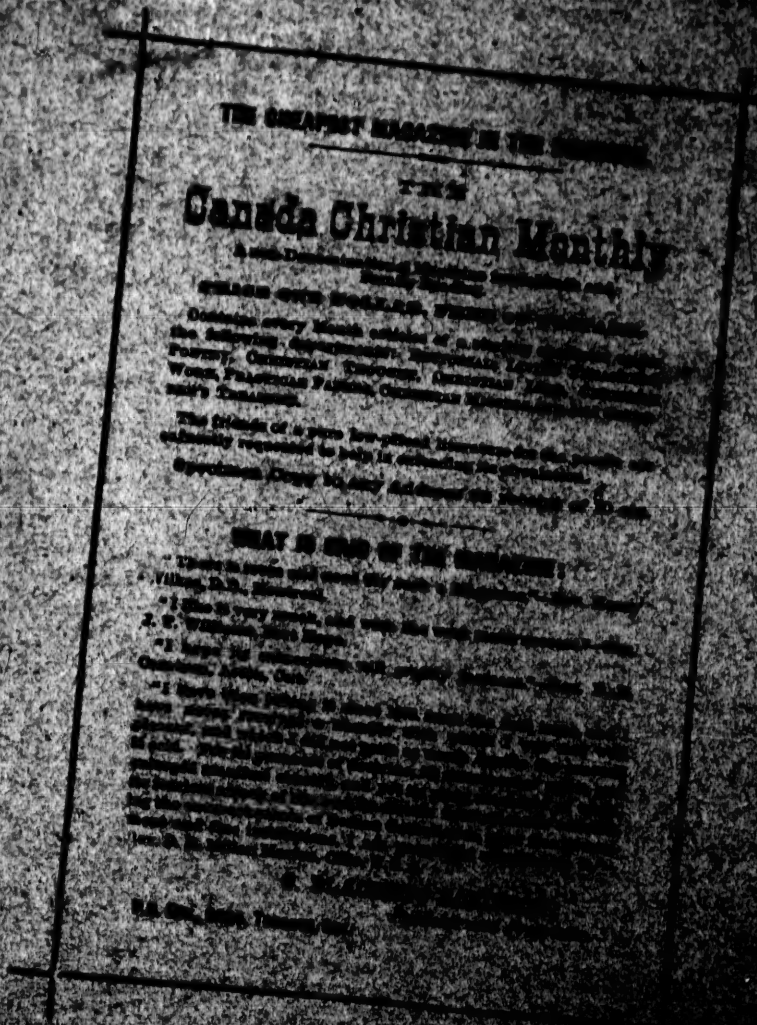

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WHAT IS DONE BY THE

form in organisms. But incontrovertibly there is a power which co-ordinates the action of these germinal points, for they are co-ordinated. You know that. Any man who has stood face to face with the results of microscopical research in the last twenty years will, I think, be very slow to adopt any other than Aristotle's definition of life. Perfectly parallel with that definition is the one given here. Life is the co-ordinating power behind the movements of germinal matter. That definition having been defended by me at great length previously I shall now use our previous conclusions. From the point of view reached in thirteen lectures on Biology I must begin—and I can only begin to-day—a reply to Maudsley.

1. Germinal matter, or bioplasm, increases in quantity as living tissues grow.

I admit that. Once every living thing was but a single naked mass of bioplasm.

2. With the increase of quantity there is an increase of the force in the germinal matter.

I admit this also. Your naked, throbbing mass of bioplasm takes on a wall and divides and subdivides and weaves the walls of its cells into tendon and nerve and muscle, and coils these around each other, according to a predetermined plan. Finally, one-fifth of the bulk of the organism is made up of germinal matter. There are many bioplasts where there was one.

3. This increase is derived from the assimilation of inorganic matter.

Conceded. We know that the individual cell takes in nutrient matter from without, transforms it into living matter, and throws it off as formed matter. You remember that there are but three kinds of matter in living tissues—nutrient matter, living matter, and formed matter. The inorganic is changed into the germinal, the germinal throws off the formed, and, as your bioplast divides and sub-divides, no doubt the matter which it weaves into these various structures is derived from the inorganic world.

4. Maudsley asks how we know that the movements of germinal matter, which are sustained by inorganic matter, did not originate in inorganic matter. He says:

"Admitting that vital transforming matter is at first derived from vital structure, it is evident that the external force and matter transformed does, in turn, become transforming force—that is, vital. And if that takes place after the vital process *has once commenced*, is it, it may be asked, extravagant to suppose that a similar transformation might at some period have *commenced* the process and may ever be doing so? The fact that in growth and development life is continually increasing from a transformation of physical and chemical forces is, after all, in favor of the presumption that it may at first have so originated. And the advocate of this view may turn upon his opponent, and demand of him how he, with due regard to the axiom that force is not self-generatory, and to the fact that living matter does increase from the size of a little cell to the magnitude of a human body, accounts for the continual production of transforming power? A definite quantity only could have been derived from the mother structure, and that must have been exhausted at an early period of growth. The obvious refuge of the vitalist is to the facts that it is impossible now to evolve life artificially out of any combination of physical and chemical forces, and that such a transformation is never witnessed save under the conditions of vitality."—("Body and Mind," Eng. ed., p. 169.)

17956.

Probably Maudsley's is the acutest question that English Materialism has ever asked. For one, I agree most cordially with Professor Bowne, of Boston University, in his exceedingly keen and fresh work on "The Philosophy of Herbert Spencer," when he says (p. 104) that "this is the best thing the correlationists have said yet, and it is the best that can be said." Wishing the whole force of this argument to be appreciated, I have cited Maudsley at length, and am anxious that he should be read, not only in his new edition of his "Physiology of Mind," 1877, but in his essays on "Body and Mind," 1873. The latter work contains a suggestive paper on "Conscience and Organization."

Maudsley is not to be disputed when he says that the germinal points absorb inorganic matter, and that they transform it into other bioplasts and the various tissues. As their power evidently grows by acquisition of power from inorganic matter, who knows but that it commenced so? That is, who knows but that spontaneous generation may be a fact, or that there is any co-ordinating power behind these rhythmically moving co-ordinated germinal points? That is the objection; and that, I suppose, is the Malakoff of English Materialism.

5. *My reply is that the power of co-ordination is the subtlest power in life, that this power resides in the original germ, and that we do not know that it is increased by the growth of the living subject.*

I admit that chemical forces are drawn into the labyrinth of activity in the living tissue; but not that the co-ordinating power behind the bioplasts is increased. Very evidently that power is not changed, for the plan of an organism is the same from first to last, through its whole growth. When I define life strictly as the co-ordinating power governing the movements of germinal points, I do not know that *this* power *is* increased by the multiplication of the bioplasts.

6. We do not know that the weaver is any more skillful when the web is half woven than when he has merely set the web and first begins to throw the shuttle.

7. There is an increase in the amount of power manifested by the organism; but there is no increase in the co-ordinating power, which is what materialism never accounts for.

The weaver has just as much co-ordinating power when the web is arranged for the first stroke of the shuttle as he has after it is woven and the finished product is held up in its glory before admiring eyes. The co-ordinating power is what I call life; and in the germ of your eagle, your man, your lion, your swallow, that co-ordinating power has a law such that there cannot come out of the germ of the lion a swallow, nor out of the germ of the swallow a lion. Everything under the law of hereditary descent breeds true to its kind. I do not see that there is the slightest evidence that this co-ordinating power is increased. Therefore, the reply is all in the correct definition of life. Give us a statement of what life means, this phrase, the co-ordinating power which directs the movements of germinal points or bioplasts, and I will defy Maudsley to prove that the co-ordinating power is increased by the growth of organ-

isms; for just as much of it is needed in these first strokes as in the last, and one would think a good deal more.

Very great conclusions follow from defining life as the co-ordinating power directing the movements of germinal matter.

8. The first law of hereditary descent is that every living thing reproduces its own kind and no other kind.

9. The co-ordinating power of life which lies behind this law exists before the co-ordinated organism into which the life enters.

10. Even Haekel and Huxley hold that life is the cause of organization, and not organization of life.

11. This transmitted co-ordinating power, therefore, does not depend on a physical environment for its existence or its habits of action, by which it always breeds true to its kind.

12. The transmitted co-ordinating power is, therefore, a capacity not dependent on experience.

13. But this transmitted original co-ordinating power in man contains the plan of his soul, as well as of his body.

14. It contains the intuitions and self-evident truths; or what are called innate or connate ideas.

15. The self-evident truths, the intuitions, the laws of the necessary beliefs are, therefore, not the result of experience, but original parts of the transmitted co-ordinating power in man and independent of the co-ordinated organism.

XIII.

NECESSARY BELIEFS INHERENT IN THE PLAN OF THE SOUL.

When we hear the noise of the falling water or the hiss of the steam which drives a loom, we do not confuse these agents with that of the weaver. The unintelligent forces of the waterfall or the steam are contrasted with the weaver, much as the blind chemical and physical forces at work in living organisms are contrasted with life. You know that the steam and the water cause the movements of the loom, and yet that the weaver co-ordinates these movements. The rude, sightless force of the waterfall and of the steam may be essential; but they do make the loom, and there can be no weaving until there is a loom. Even after the appropiate mechanism has been brought into existence, you must have the weaver to co-ordinate its activities. He does not put forth all the force there is in the loom; but he co-ordinates it all. Surely there is a distinction between co-ordinating and causing the movements of germinal matter. Sometimes the weaver makes the loom and moves it too. In this life chemical and physical forces play through the organism; but when we drop the natural and acquire a spiritual body perhaps the change is analogous to that which occurs when a weaver, whose loom has been moved by a waterfall or steam, dispenses with their aid and sets the loom in motion by his own force.

In the defense of the authority of the necessary beliefs or axiomatic truths of intellect and conscience against the pretenses of materialism, what are some of the uses which can be made of a correct definition of life?

1. Correctly defined, life in physical organisms *is the power which co-ordinates the movements of germinal matter.*

2. This definition is not intended to apply to disembodied life, nor to the Divine Existence.

Of course, we do not suppose that there is any germinal matter in the organization of the Angel Gabriel. Ours is a definition not of life merely, but of life in physical organisms.

3. It is identical with Aristotle's definition of life as the cause of form in organisms.

4. Co-ordination the greatest marvel in the structure of living tissues, is by this definition put in the foreground.

5 But the co-ordination of the movements of germinal matter or bioplasm only is mentioned, for no other form of matter in living tissues has the power of movement.

Inorganic matter does not move, formed matter does not move, except as each is moved by the bioplasts. To account for the changes in the position of the former, we must, therefore, fasten our attention on the movements of the latter. The defect of Spencer's and of many another attempted definition of life in physical organisms is that such life is not spoken of as connected always with germinal matter. Spencer is justly criticised by Drysdale for not confining the range of his definition to this peculiar kind of matter called bioplasm.—(Drysdale, "Protoplasmic Theory of Life," London, 1874, p. 176.) It is now conceded, even by Huxley, that life exists only in the matter of the bioplasts. Where life came from, he says, we do not know; but we do know that, so far as human observation has extended, life has been found only in connection with bioplasm. Therefore, in the definition of life in physical organism bioplasm must be prominently mentioned.

Why not say that life in physical organisms is the power which co-ordinates the movements of the bioplasts? Because there are individual animalcules, which have life and yet consist apparently not of many bioplasts, but of a single naked, throbbing mass of this germinal matter. When such an animal wishes to digest its food, it sometimes thrusts it into its side, making a stomach there and absorbing its nutriment; and then the debris is removed and the animal is whole again. This proceeding evidently involves a co-ordination of movements; and we say that the action by which such an animalcule digests its food is not the result of chemical and mechanical forces merely, but of life that directs them, or of a power which co ordinates the throbbing of that single mass of bioplasm of which the animalcule may consist. There is a co-ordination there, such that a process essential to the preservation of the animal is carried through triumphantly, and the chemical and physical forces, as we have seen in previous lectures, do not account for that co-ordination. Something must account for it, and that something we call life. The power is there, for we see its effects. But when we rise to more complex organisms the fact of co-ordination, stands out before us with blazing vividness. We have co-ordination upon co-ordination, wheel within wheel, and the cause of the co-ordination we call life.

6. The definition does not assert that life *causes* the movements of the germinal points, or bioplasts; but only that it *co-ordinates* those movements.

7. It does not deny that chemical and physical forces may act through the bioplasts; only that these forces can account for the co-ordination of their action, or for the orig'nation and preservation of form in organisms.

What follows from this definition?

It is my conviction that, in discussing the nature of life, our faces are turned toward a land in which most important discoveries are to be made in the next century. My feeling is that the debate between atheists and theists is to be settled in the country of which we now stand on the edges in biology. So

far as there is a debate concerning fundamental truth, so far as the great questions concerning necessary beliefs are drawn into dispute, they are to be settled here; partly by biological and partly by metaphysical knowledge. The great Scottish-American metaphysician, President McCosh, of Princeton, has spent a life in opposing the associational school in philosophy. His various defenses of the fundamental truths, intuitions, axioms, and necessary beliefs are the best that have been made in the English language and from the metaphysical side of research since the death of Sir William Hamilton.—(See Mill's Reply to McCosh, and in the third edition of his "Examination of Hamilton's Philosophy," and the Reply to Mill, in the Appendix to McCosh's "Defense of Fundamental Truth," pp. 435–470.) He said to me the other evening what he has often said publicly and, what I therefore venture to quote: "The associational school is disappearing. It soon will have disappeared entirely. Schopenhauer and Hartmann, too, will disappear. Hermann Lotze will not. It is wise to keep now in the fore-ground the physiological part of philsophy, for that is the battle-field of the future." The defense of fundamental truth upon which I am venturing here is based upon physiological considerations quite as much as upon metaphysical. It is, in short, to stand upon that definition of life which I hope was defended adequately in thirteen lectures which have already been given here on Biology. If we are convinced that life has been correctly defined, we can now go on to make inferences from that definition of the most commanding interest.

1. Matter is co-ordinated in living tissues.

Who doubts that? Nobody who has eyes. Since there is nothing so good as eyesight for the quenching of doubt on all biological questions, I beg leave to suggest to those who are not deficient in leisure that one of the best objects they can buy in these days of costly Christmas presents is an efficient microscope. There is more and more use of the microscope in the world by all students of philosophy. Sometimes serious interests are subserved even by the amateur study of Biology. You can in the few evenings at your disposal, in a couple of years, make yourselves competent to read the very best specialists in biological science. Until you read them and learn how to test their processes and to obtain knowledge at first hand, you may find your minds full of unrest on all these great physiological and philosophical themes. Until you can approach intelligently the supreme authorities among the specialists on these topics, you may be easily misled by second-rate materialistic writers; and, therefore, I advise you, as a guide in biological reading, to make an adequate personal study of living tissues. I follow my own advice. Perhaps it is improper to hint that I own a microscope, as it seems to be taken for granted by certain critics of the bravely-anonymous species that this is not the fact. But it is proper for me to state that this city has the credit of having produced the best microscope in America, a kind of freak of science and fortune—a one seventy-fifth of objective, something unknown anywhere else in the world; and one that perhaps could not now be produced again. Photographs taken by this instrument I have seen commended most highly in the Paris *Journal de Micrographie* (num-

ber for November 1877). That microscope is at the service of this audience, and I hope to bring to you testimony from it again and again in the course of the next few months, as I did last winter in the lectures on Biology. Some time, when the noon can be darkened in this room, I am to give you its work actually in progress on a screen here, so that we shall get at the facts at first hand.

I understand that some think that they are not in Orthodox company when they are in my company and yours. It is supposed that Orthodoxy is in danger from this lectureship. I have heard that an eminent naturalist "is not clear that he is in Orthodox company" when he has the companionship of bishop Butler himself. It has been hinted here that Butler and Agassiz are perhaps correct in assuming that the argument for man's immortality, by striking against the possibility of the immortality of instinct, is not wrecked but glorified. For saying precisely what Bishop Butler has said ("Analogy," part 1, chap. 1) I have lately been sharply assailed by a man who fights under a mask indeed, but who, although calling himself a prominent naturalist, from the beginning to the end of his article points out not one single error of biological fact in a discussion which he blames you for applauding ignorantly. When this house is as full as it is to-day, there are in it—among the fifteen hundred or two thousand persons present and representing all shades of opinion—at least three or five hundred who know what they are about; and I repel indignantly all the scapegrace scribble of anonymous writers, whether in the newspaper or quarterly press, against an audience which has been drawn together here now for more than a year in the busiest hour of the busiest day of the week, simply by large and complicated themes and not by the speaker. You have come here to listen to very imperfect discussions of very important themes; and although I am not a native of New England, I dare affirm that there is not on this continent another city that would send out for so long a period and at such an hour an audience as large as this to study problems as complicated as those that have come before you. My opinions are not worth a rush; but the general agreement of five or eight hundred or a thousand scholarly persons is a sign of the times. You blame me for having allowed a renowned publishing firm, whose judgment in matters of taste is not often questioned, to preserve a little record, made not by me but by the stenographer, of what this audience has said. Thomas Carlyle made a speech at Edinburgh, the lord rector's inaugural address, before scholars and the people at large. He sits down to edit his works in a costly final edition for posthumous circulation. He left in all the audience said.—(See Carlyle's "Collected Works," Vol. XI., pp. 295–334). It would have been my preference, as a matter of taste, to have left out what this audience said; but it is so peculiar an audience that it was thought the examples of Carlyle and Phillips—for Phillips's speeches are edited in the same way, hisses and all recorded—were worth following. Had I been hissed here as often as Phillips was in the days of the Anti-slavery contest, I should have thought those remarks of the audience quite as worthy of preservation as the others; and if any have thought that the audience has expressed

itself partially, please let the other side be heard here and it shall be recorded. I have not the honour of a personal acquaintance with fifty persons in this audience. It appears to be thought that I have paid people for coming here and approving what may happen to be said on this platform. There are no deacons in this church, and no creed either, except clearness. I am entirely free, I suppose, from bondage here, except to the law of the survival of the fittest. You come here for reasons best known to yourselves, and assuredly you are perfectly independent of this platform. The public understands these facts. What you have said, if you please, has gone very much further than anything I have said. Pardon me for this digression, caused by some scandalously scapegrace attacks; but let me affirm that there was not a little consideration of the matter before it was decided that what you said should be preserved in any record of the proceedings here. I repeat that, as a matter of taste, I should have been willing to have left it out; but as a matter of influence, and as a means of tiding readers through dry discussion, I was willing to leave it in, after the precedents of Phillips and Carlyle. I hold that my opinions are not worth noticing; but that the general agreement, week after week, month after month, and I had almost said year after year, of an audience as peculiar as this is a sign of the times, and I find that those who are most opposed to what you have said, and to its being recorded, are those who are most opposed to the opinions you have approved.

2. Some adequate force co-ordinates matter in living tissues.

3. The co-ordinating force must exist before it can act.

4. It must act before it can co-ordinate the matter contained in the tissues.

5. The co-ordinating force, therefore, exists and acts before the organism which it co-ordinates.

Excuse the shortness of the steps I take in the elementary stages of this argument. It is very necessary, occasionally, in following out the links of a course of thought, to use propositions that seem self-evident. The strength of an argument is in the self-evident propositions which it contains. Using often here the form of statement which the logicians call a *catena*, I shall be allowed, for the sake of brevity and clearness, to develope argument by the use of ordinal numbers for cardinal points.

6. The co-ordinating force, directing the movements of germinal matter, is defined as life.

7. Life, therefore, is the cause of organization, and not organization the cause of life.

8. As the cause must go before the effect, life exists and acts before the organization which it causes.

9. It exists and acts on a plan.

10. In each different type of physical organism it exists and acts on a different plan.

11. Every living being breeds true to its kind.

We now approach wholly new matter in the shape of inference from propositions already elaborately discussed here.

12. In the transmission of the co-ordinating force called life, the force remains unchanged in the type of its action.

Of course, I am not forgetting the slight exceptions to this law, or variation in heredity; but, to speak roundly, the great rule of hereditary descent is that like breeds like.

13. The different types of organisms are implicitly contained in the co-ordinating force of their several germs.

14. The different physical organs are in the plan of this co-ordinating force.

15. The different spiritual faculties, including the conscience in the case of man, are implicitly provided for in the plan on which the co-ordinating force acts.

Consider the marvel of a tropical forest. Charles Kingsley, with powers of description rarely matched, pictures for us the High Woods he entered on a day of which you will read the record in his fascinating book "At Last,"—a prose poem from its opening to its close. Palms of twenty species towered above his head there under the torrid noon, and around them ran vines of hundreds of kinds, fattening in the tropical sunlight. Minor shrubs sprang up, filling all the interstices of the woods. Ripened fruits, which we gather and prize as rarities, were dropping through the scented silence. On the ground he looked for refuse; but found none. He searched for the debris of fallen trunks; but that was no longer visible, for such is the vigor of tropical growths that this refuse of the woods is sucked up at once into the enlarging tissues of the vegetation standing in the soil. There are no rotting leaves and trunks in a great tropical forest. The matter contained in such sheddings is absorbed swiftly into the fatness of the vegetation, which grows so rapidly that you may almost hear its progress. Above you are fifty kinds of birds; around you as many kinds of animals; a million kinds of life of all sorts,—insects, birds, animals, trees, plants. And now you know, my friends, perfectly well, that every seed in that tangle of the tropics produces its like. There is in all the collision of tendencies in that marvel of intricate forces, with power striking upon power, no jostling of a predetermined plan off its grooves. Your palm always breeds a palm, your parrot a parrot, your ape an ape, and your invisible insect one like itself. There is no shrub so lowly, there is no animal so lordly as to be free from the power of the law by which like breeds like. The co-ordination of all these forms proceeds from some adequate cause. Wherever an organic form is produced, we find that in the origin of it there are forces at work which land on the mystic bioplasmic shore, with a constitution. Our fathers, off the coast of Massachusetts, assembled in the cabin of the "Mayflower," and, before they landed, drew up a civil compact. They put foot on Plymouth Rock by no means carelessly. They landed on the American coast with a plan. Just so in this tropical forest, although there are a million coasts, and a million boats

drawing near them, every boat has a plan. In the cabin of every ship that is to touch that mystic strand of the tropics we have a council and a compact drawn up. Certain it is that among the million Plymouth Rocks on which the co-ordinating powers of the germs land there is not one pressed by a careless foot. Everywhere the co-ordinating powers land on the bioplasmic shore, each with a constitution drawn up beforehand in the cabin of its "Mayflower."

The constitution of a germ is a compact which cannot be lightly changed. We see that there must be conflicts in the tropical forest. There are the Norse palms and the Puritan pines. Here are the Dutch and the Norwegians; here are all tribes of men represented by the different classes of vegetation. They collide; they are all under the law of the struggle for existence and the survival of the fittest; but they adhere to their types. These compacts, arranged in the cabins of the "Mayflowers," are respected, in spite of all jostlings of forces off their grooves. Indeed, there is no jostling of a force off its grooves unless after ages and ages of slight variation. I am not denying the law of variation in asserting roundly the law of heredity in sameness. The plan is there as the bioplasmic boats land, and we may defy all science to deny the assertion that everything there is in the form of the palm, is in the plan that was arranged in the cabin of the "Mayflower" of the palm, before the boat of the palm touched the coast. Everything there is in the plan of the parrot was in the thought of the occupants of the "Mayflower" of the parrot before it landed. There is a constitution brought to the Plymouth Rock of every germ. In that constitution I hold that we have a plan, not only of the form of the body, but of the faculties and intuitive beliefs of the soul.

Go back, however, to the time when, as some say, the types of all germs were only four in number. Darwin has never committed himself to materialistic evolution. He has always asserted that the first living germs were brought into existence by the Creator of all things. But now, if you put into these first germs a constitution that will develope on one line into vertebrates, on another into radiates, on another into articulates, and on another into mollusks, you have four fundamental forms of life, as Agassiz taught. Even when you reduce these Plymouth Rocks to four, you do not reduce the number of words in your constitutions at all. In the four constitutions of the vertebrates, articulates, radiates, and mollusks are contained implicitly all the provisions which your millions and millions of constitutions developed from the four contained explicitly. These four constitutions might be reduced to one, and yet contain no fewer syllables. In the mystic constitution of your original germinal matter you have the sum of all the provisions of the multitudinous constitutions developed from it to show that when God landed on the bioplasmic shore which he had himself created, he landed with a plan. There was in the cabin of the "Mayflower," which preceded the first germinal matter, a compact drawn up; and in it were the possibilities of all divergencies from the first life, or the syllables describing all the multitudinously interlaced forms of vegetation and animal existence in this tropical forest. Whatever there is wonderful in development was in the original

source of the developing process; so that I am justified in asserting that the reduction of all the constitutions or types of life to four, or even of the four to one, is no reduction of the marvel of the original compact in the cabin of God's heart.

If matter is inert, we know that it does not move itself; and assuredly it is getting to be time for us to give up the theory that matter is not matter and can move itself, now that Tyndall has done so. Look into that Birmingham address. You will find Tyndall saying that, if matter has two sides, a physical and a spiritual, we must account for the two sides; and that it is just as hard to account for the two sides as it is to adopt the hypothesis that matter does not originate force.—(See Tyndall's Birmingham Address, in *Fortnightly Review*, December, 1877.) The doctrine of the lectures given on this platform is what is usually called "ideal realism"—scholars will allow me to use the technical phrase; the doctrine of Germany at this moment in her academic philosophy, not in her unacademic. Separate always the two great schools of recent German philosophy—the academic and the non-academic.

The New York *Tribune* lately did not know who Hermann Lotze is; but it appears that Professor Wundt, of Heidelberg, does. (See Wundt's essay on German Philosophy, in *Mind*, October, 1877). If any of you will read a series of articles by Lotze, that are to appear in *The Contemporary Review*, or the references to him in the now quarterly called *Mind*, or the translation of *Mikrokosmos*, which is to be given to the world soon, as I hear, by a scholar of our Cambridge, you will be able to make in English an acquaintance with this man. Probably the *Tribune* does not read the *Zeitschrift fur Philosophie*, published at Halle. This is the foremost philosophical journal of its class in the world, and is full of the work of Lotze and of his school in modern German thought. It is unfortunate and unnatural that the literary editor of the *Tribune*, who has the public reputation of being a friend of Theodore Parker, should appear to have no outlook in philosophy beyond the Straits of Dover, or, at least, none any later than those misleading glimpses which Parker caught. If this able and honoured newspaper knows nothing of Hermann Lotze, it is so much the worse, not for him, but for one department of the New York *Tribune*. The doctrine of established philosophy in Germany is ideal realism, and that is all that I am asserting. Matter has no capacity to originate force or motion. It may transmit it, but it does not originate it, and so the power of co-ordinating tissues, or of producing life, does not belong to it. Besides matter, there is but one other thing in the universe, mind; and so, behind the movements of matter there must be mind. Although mind may be co-extensive with matter, the identity of mind and matter cannot be asserted by any one who loves clear ideas. Therefore, the co-ordinating power, the constitution drawn up in the cabin of the "Mayflower," is to be attributed to mind.

16. Among the faculties of the soul provided for in the plan which antedates the germ of the body are the perceptions of self-evident truths, both intellectual and moral.

17. The necessary beliefs of the Intellect and Conscience are, therefore, in the original plan of the soul.

18. They are brought into activity by experience.

The loom is worthless unless it has something to weave. When I affirm that the necessary beliefs are connate, I do not assert that they effect anything for philosophy before we come into contact with the exterior world and with our own inner world. We must have something to weave before we can produce a web. But, in spite of all that, the web is not the loom; neither did the web, or waterfall, or steam produce the loom.

19. *As original parts of the co-ordinating power inherent in the origination and transmission of life, the necessary beliefs of the Intellect and Conscience are as independent of the structure and environment of the co-ordinated organism as a cause is of its effect.*

20. As original parts of the co-ordinating power called life, they are as independent of the habits or experience of the co-ordinated organism as the loom is independent of the plan of the web, or of the water and of the steam which throws it into action.

21. *As original parts of the transmitted co-ordinating power in man, and as independent of their own effects, the necessary beliefs cannot be invalidated by the pretence that they depend on our environment and would have been different had our experience been different.*

Has this discussion a practical bearing? I can go to twenty universities in the world and find young men asserting that one thing is just as divine as another. Wrong is as natural as right, and whatever is natural is divine. The moral intuitions, of which the ethical teachers say so much, are only one part of nature; the worst passions are another part; and what gives one portion of nature authority over another? The bad man is brought forth by the Supreme Powers, and the good man is; and to a consistent materialism the one is just as divine as the other. If I go to Tyndall and Hackel, they say that the one is no more responsible than the other, and that the will is never free. How are we to justify anything like clearness of thought in ethical philosophy unless we can justify these fundamental beliefs, which materialism itself takes for granted, but with which it plays fast and loose. These perceptions of primitive axioms are something not depending on anything outside of us; but are original capacities of the constitution of the soul, and would have been the same no matter what our experience had been. When a doctrine works badly, I hold that it is scientifically discredited, as out of harmony with the nature of things, and this doctrine that the fundamental beliefs are useless, or uncertain sources of knowledge, works disastrously in the long range. I do not mention these evil effects of denying self-evident truths as proof that our necessary beliefs are authoritative; but I use these effects to illustrate the fact that there are practical issues involved, of the most transcendent consequence, in the justification of fundamental truth. All we can say concerning conscience is undermined for some by a certain philosophy of hereditary descent, which asserts that even the moral perceptions

of self-evident ethical truth are solely the result of habit, and might have been different had our ancestors had a different environment. The intuitions represent no outward reality. We may as well, in the fog of our philosophy, when we knew but very little, follow impulse, and forget entirely all that is said on this topic of the self-evident intellectual and moral truths.

22. The necessary beliefs, or perceptions of self-evident truths, therefore, are a part of the original revelation given to the soul by its Author in the very plan according to which it exists and acts.

23. As such, the necessary beliefs of the Intellect and Conscience are the supreme and final tests of truth, or the unassailable guaranty of all mathematical and ethical axioms.

24. An adequate defence of fundamental truth, therefore, is made by the establishment of a proper definition of life.

XIV.

DARWIN'S THEORY OF PANGENESIS, OR HEREDITARY DESCENT.

In the field of the battle of Waterloo there was a concealed ditch of Oheim, into which regiments in retreat, pushed on mercilessly by their companions and pursuers in the rear, were cast alive, until the gap was full, and the hosts who were escaping from death passed across the chasm in safety on the bridge of their dead predecessors. The ditch of Oheim in the battle of Waterloo between the theistic and materialistic forms of the theory of evolution is hereditary descent. How are we to fill up the chasm between life in the parent and life in the child, and use only the narrow mechanical theory of the origin of living tissues and of the soul? Say what you please of the subtler forms of German materialism, which I am not now discussing, the English forms are only other shapes of the old Lucretian atomic theory. My opinion is that, at the last analysis, every mechanical theory of life is only a redressed ghost of Lucretius. At any rate, when candidly unmasked, whatever has been given to us from England in support of materialism exhibits the faded features of the Lucretian hypothesis. Many and many a theory has fallen into the ditch of Oheim in this battle. Lucretius himself lies there at the bottom, a corpse. Fifty proud systems of materialistic philosophy lie above it; and now, writhing there on the very summit, under the hoofs of the retreating hosts, lies Darwin's theory of pangenesis.

What is Darwin's famous provisional hypothesis of pangenesis, and what are some of the replies to it? First, let me give you an outline of the theory in language containing no technical terms; next, let me state the theory in Darwin's own words; and afterward permit me to mention the more important of the objections which may be made to its fundamental propositions.

Suppose that we have here a single naked mass of homogeneous bioplasm [drawing a figure like that of an amœba upon the blackboard]. Let it be assumed that this piece of germinal matter is of one and the same substance in all its parts. It may be a living creature of one of the lowest types. If, now, this throbbing homogeneous bioplasm throws off from any part of its substance a portion of itself, the divided offspring will have qualities like those found in every part of its parent. We know that it is a peculiarity of bioplasm to divide and subdivide itself. By a marvelous law of growth, the divided portions, when

properly nourished, increase in size and acquire all the qualities of their parent. A minute particle or gemmule thrown off from a single mass of homogeneous bioplasm grows, according to the laws which belong to its parent, and becomes a mass like that from which it dropped off. Physical identity between the parent and the child is the groundwork of the explanation of the physical side of the law of heredity in sameness.

But now suppose that this animalcule, instead of being a single mass of bioplasm, consists of a more or less intricate structure. Let it be assumed that the upper and lower side differ, and that each of these has qualities distinct from those of the middle portion. If you are to account for the reproduction of that triplicate animal, you, according to Darwin's theory of pangenesis must suppose a small mass of bioplasm thrown off from the lower section, and another from the middle part, and another from the upper. Call the three portions of the animal 1, 2, and 3, and the gemmules thrown off from these parts respectively A, B, and C [illustrating on blackboard]. A will have the qualities of the portion of the animal from which it comes—that is of 1. B will possess the qualities of 2, and C of 3.

You have in this second case of hereditary descent, the law of identity of substance in parent and gemmule carried out in a threefold manner. There is identity between 1 and A, 2 and B, and 3 and C. The nourishing of the three gemmules will result, therefore, not in changing A into B, or B into C, or the reverse; but in changing A into a second 1, B into a second 2, C into a second 3. When, now, this result has been accomplished, how shall we account for the arrangement of the newly-developed parts in the proper manner. Everything turns on their being collocated as 1, 2, and 3, and in no other order. Here comes into Darwin's theory, therefore, in spite of his theistic concessions as to the origin of the first germs, the great and vague materialistic word affinity. When the gemmules have begun to be developed, "elective affinities" start up between them, and they arrange themselves in the order exhibited by the parts of the original animal. We understand none too well how a single gemmule develops itself into a form like its parent. The permutations that may be rung on three numbers are very considerable; but soon we shall see gemmules choosing the one right combination out of all permutations possible in billions and trillions of numbers. It is not absolutely inconceivable, however that, when an animal has three separate parts a gemmule from each part should by its physical identity with the part from which it comes inherit the property of developing into that part. But, on Darwin's implied theory of life, what causes these three parts to put themselves together in the proper way? Were either gemmule to forget its place, we should have a singular animal in the progress of that development. In the hurling about of all these gemmules, under merely chemical and physical forces, what keeps these three particles from ever getting out of place? How much must be meant by elective affinities in Darwin's *hypothesis*, which can be called a *theory* only by courtesy?

Materialism assures us that a co-ordinating power independent of matter is

a dream, a poetic idea! Huxley says that "a mass of living protoplasm is simply a molecular machine of great complexity, the *total* results of the working of which, or its vital phenomena, depend, on the one hand, on its construction, and, on the other, upon the energy supplied to it; and to speak of vitality as anything but the name of a series of operations is as if one should talk of the horology of a clock."—(*Encyc. Brit., Art. Biology.*) Huxley is not a materialist, you say; but I must judge men by their definitions. And although there are many schools of materialism, I affirm, knowing what risks I run—I have run risks here for two years and run yet—that this definition of Huxley's represents one of the most dangerous schools of materialism; for it assumes that the forces at work in the formation of the organism are merely chemical and mechanical. There is no life, no co-ordinating power behind the tissues.

If, therefore, you build your theory of descent on the mechanical and chemical forces merely, you must rest the weight of your case on that word "affinity." There are elective affinities between the gemmules of the different parts of an organism, and the result of these affinities is to put the germinal points together in the right order, so that the resulting animal shall be brought into existence right side up. Assuredly, your affinities must be very peculiar forces. Can they be simply chemical and mechanical and yet adequate to their work? How is it that the gemmules seem to be possessed of an inflexible purpose of coming together in the right form, so that the animal shall be built up 1, 2, 3, and not 3, 2, 1? What if I should get into the middle? Nothing but mechanical and chemical forces here, Huxley affirms. Darwin refuses in this theory of pangenesis to employ any other word than affinity. To talk about other forces would be like talking of the horology of a clock! (Of course, it is expected that whoever wishes to follow the discussion here will read the printed report and look up all the references. I am only too anxious that you should examine the original utterances on these subjects. I cannot, in the time given here, make every point clear unless you will look up the references made in print.)

If the affinities which bring the gemmules together in the right order are merely chemical, they are affinities of a kind chemistry knows nothing of anywhere else. Here is a species of affinity that exists only in germinal matter. Even in that kind of matter, which to all human tests is chemically the same in many different kinds of germs, the plans of the affinities differ as endlessly as the types of life.

If, now, you will multiply the three parts of this small organism, thus far used as an illustration, by a number representing the multitudinous parts in the most highly organized animal, and apply the same law of descent, you have Darwin's theory of pangenesis. We have here [drawing a figure on the blackboard], let us suppose, the outlines of some highly complex form of organism. I care not what—the foot of a frog or the back of my hand. It is a mass of interlaced living tissues, and it is crossed in every direction by forms differing from each other in outline, position, and activity. This colored biological chart

is only too inadequate an illustration of the complexity of the weaving performed by the bioplasts.

We have as many different parts in one of these tissues as there ever was in lace-work, and multitudinously more. We know that. But Darwin says that, just as every part of a small and simple organism throws off a gemmule, so every part of a complex organism throws off its gemmule. That is, we have a gemmule from this corner [indicating on the blackboard], a gemmule from this, a gemmule from this, a gemmule from every one of these subdivided lines; a gemmule, in short, from every cell of this organism; a complexity absolutely appalling to contemplate, for the number of gemmules must be absolutely inconceivable. But, although they go out into the circulating fluids of the organism, although in the vegetable world they permeate all the sap in your lily of the valley, they are, nevertheless, collected into the pollen of that flower. Every grain of that dust consists of aggregates of all these gemmules. Therefore, when a pollen grain is subjected to the proper environment, the gemmules develop. They all have a number. There may be billions and trillions of them; but no particle forgets its place. The dance of the gemmules is a labyrinth compared with which all the movements, seen and unseen, of all the visible and invisible stars of heaven is simplicity. But these points of matter, with nothing but chemical and physical forces behind them, as Haeckel and Huxley would say, or with nothing but *elective affinities* behind them, as Darwin would say, never make a mistake in a single step. They come together, they arrange themselves, they build a germ that will produce the lily of the valley. They co-ordinate themselves so as to constitute a seed which you cannot develop into anything but a lily of the valley, if the gemmules come from the lily, and into nothing but a palm or a man, if the gemmules have come from these organisms.

Gemmules, it is supposed, will develop only in union with nascent cell, like those from which they came. Here are three cells arranged in a series, and the second grows out of the first and the third out of the second. When all these cells are developed, each drops off a gemmule. But the gemmule produced by the second cell will not develop itself unless it comes into union with a gemmule originated by the first cell and already started in its growth. The gemmule from the third cell must have a corresponding position in relation to the gemmule of the second, or it will not grow. Thus our elective affinities, the complexity of which has already astounded us, need to be raised to a yet more inconceivable height of complexity. We are bewildered under the demands of this theory; but the gemmules are not bewildered. Elective affinity keeps their poor heads steady. Each gemmule bethinks itself of its duties, takes its proper place in the swirl of atoms and forces, and, with no co-ordinating power outside of itself, goes unerringly to its destination. There is your theory of pangenesis complete.

Let me now give you Darwin's own language:

"It is universally admitted that the cells or units of the body increase by subdivision or proliferation, retaining the same nature, and that they ultimately become

converted into the various tissues and substances of the body. But, besides this means of increase, I assume that the units throw off minute granules, which are dispersed throughout the whole system; that these, when supplied with proper nutriment, multiply by self-division, and are ultimately developed into units, like those from which they were originally derived. These granules may be called gemmules. They are collected from all parts of the system to constitute the sexual elements, and their development in the next generation forms a new being; but they are likewise capable of transmission, in a dormant state, to future generations, and may then be developed. Their development depends on their union with other partially developed or nascent cells, which precede them in the regular course of growth. Gemmules are supposed to be thrown off by *every* unit or cell, not only during the adult state, but during *each* stage of development of every organism; but not necessarily during the continued existence of the same unit. Lastly, I assume that the gemmules, in their dormant state, have a mutual affinity for each other, leading to their aggregation into buds or into the sexual elements. *Hence, it is not the reproductive organs or buds which generate new organisms, but the units of which each individual is composed.* These assumptions constitute the provisional hypothesis which I have called pangenesis."—("Animals and Plants under Domestication," Vol. II, chap. x, Am. ed., pp. 369, 370.)

Every unit, or cell, during each stage of the development of every organism throws off its gemmules. What smooth language for the multitudinous numbers that must be thrown off! Each stage may mean every three minutes, for a new stage is reached in some rapidly-developing plants in every three times sixty seconds.

"If one of the Protozoa be formed, as it appears under the microscope, of a small mass of homogeneous gelatinous matter, a minute particle or gemmule thrown off from any part and nourished under favourable circumstances would produce the whole; but if the upper and lower surfaces were to differ in texture from each other and from the central portion, then all three parts would have to throw off gemmules, which, when aggregated by mutual *affinity*, would form either buds or the sexual elements, and would ultimately be developed into a similar organism. Precisely the same view may be extended to one of the higher animals; although in this case many thousand gemmules must be thrown off from the various parts of the body at each stage of development, these gemmules being developed in union with pre-existing nascent cells in due order of succession."—(*Ibid*, p. 371.)

What are some of the replies to be made to Darwin's hypothesis of pangenesis?

1. The hypothetical gemmules may pass everywhere through the tissues living organisms. They are inconceivably small.

Charles Darwin calls Lionel Beale "a great authority" ("Animals and Plants under Domestication," Vol. II., p. 372). I fear some Darwinians who read Beale are not candid enough to agree with their master in that opinion. But when Darwin cites Beale he is so frank as to say that this theory of pangenesis has been opposed most emphatically by Lionel Beale and by Mivart and by Professor Delphino, of Florence, whose suggestions, Darwin says, he found very useful. This great authority, Lionel Beale, of whom we have heard here before to-day, admits that there may be masses of bioplasm too small to be seen with the highest powers of our present microscopes. The gemmules, however, on the theory of pangenesis, must be almost inconceivably smaller than those assumed particles of bioplasm; for every such particle in every stage of growth must throw off a gemmule, and these gemmules from all the bioplasmic

points of the body must be collected in a little shifting dust, which we call the pollen of a plant. In your palm and your oak there are millions of bioplasmic points; but, according to Darwin's theory, every unit, that is, every cell, every bioplasmic point, in every stage of its growth, must throw off gemmules, and these must be collected together in the pollen. The gemmules must be inconceivably small to be contained in so narrow receptacles. They cannot be absolutely infinite in numbers, however; for, if so, they could not be nourished. Darwin himself says that, "excessively minute and numerous as the gemmules are believed to be, an infinite number, derived, during a long course of modification and descent, from each unit of each progenitor, could not be supported or nourished by the organism."—("Animals and Plants under Domestication," Vol. II., chap. x., Am. ed., p. 396). Nevertheless, they are so small as to be wholly invisible to the microscope. That is an important point, for it makes the theory one which it is very difficult to disprove. The gemmules are objects of the imagination. How are we to disprove their existence? You may imagine the gemmules floating in the blood and permeating tissues which the blood cannot penetrate, If you are of those who establish their theories by supposing that what cannot be disproved is proved, then you may prove the existence of these gemmules. Nobody can easily disprove the existence of physical masses which the highest microscope cannot perceive. It is all a matter of imagination—the existence of the gemmules—and will be, probably, for ages and ages yet; for no microscope pretends to see anything as small as these gemmules must be.

One thing, however, we do know—that, if the pangenetic gemmules are inconceivably small, they must pass everywhere through the living tissues. They easily permeate cell-walls. Therefore, in the vegetable kingdom, when the gemmules pass freely from cell to cell, we should suppose that a bud borne by a graft would certainly be affected by the gemmules arising in the root and stem of the stock. Such is not the case in many instances. Pips from a pear grafted on a quince stock will not give rise to a hybrid between a pear and quince. The stone of a peach grafted on a plum stalk will not grow into a tree whose stalk bears plums, while the extremities of the branches bear peaches.

The gemmules of the quince are thrown through the walls of the cells in the scion of the pear, they circulate in its sap, and we should suppose that they would produce a hybrid. But they do not. We know they circulate in the scion, if they are as small as they must be according to this theory. But we cannot trace them by the effects the theory requires them to produce, if they are there. We find no effects; therefore, we suppose they are not there.

2. Pangenetic gemmules might pass everywhere. They can leave the body in the perspiration and the breath. There is no explanation in Mr. Darwin's theory, for the presumed fact that they are all collected into buds, pollen, or any one similar receptacle.—(See Letter by Lionel Beale in *Nature*, May 11th, 1871, p. 26).

Pardon me if I expand that point, for the sake of making it clear; for, in

our hurry of discussion and want of time, I am perpetually under temptation here to run into obscurity, from condensation. It is assumed that every cell of every tissue throws off a gemmule in every stage of its development. Now, the gemmules are so small that they may be breathed away,—they may be perspired away. Your lily of the valley, and your palm tossed in the winds may exude gemmules through all their pores. How happens it that the representatives of no one cell are ever exuded, or breathed away in any case? Gemmules may go anywhere. But, in spite of all the tossings of the tissues, in spite of all the activities of the tissues in organisms that are constantly in motion, we find no one class of these gemmules lost. If, for instance, the gemmules that come from the lenses in the eye were to be perspired away, or if, as they circulate through the blood, they were to be breathed away, there would be no eyes in the offspring. Now, how is it that there is nothing lost out of this marvelously complex mass of gemmules, when they are so inconceivably minute that hunting for a needle in a haymow is plain business compared with looking for a gemmule? This is the best form of the mechanical theory of life, and in the name of theories as wild as this some of us are asked to give up our belief in the immortality of the soul.

8. The hypothesis makes no distinction between a unit of matter and the unit of force in a living organism.

The individual type of life, or co-ordinating power in a germ or organism, I call the unit of force in that germ or organism. A single naked bioplasmic mass is the unit of matter. Cells are not the true units of matter in an organism. If the gemmules are formed by the breaking off of minute masses from the units of matter or naked bioplasts, these will not arrange themselves, unless the unit of force or co-ordinating power of life is behind them.

It is vastly important, I think, to make a distinction between the unit of matter and the unit of force in a living organism. The unit of matter, at the last analysis we can make in upbraiding the living tissues, is the structureless naked bioplast. But we know that behind the throbbing weaving bioplasts there is a unit of force, co-ordinating their motion. As the plan on which they weave preserves its unity in all stages of development of the animal, we conclude that the unit of force behind them preserves its unity. Take [illegible] points as you please, therefore, of these units of matter, and you cannot [illegible]m unless you have your co-ordinating power behind them; and, [illegible], you gain nothing by your theory of elective affinities.

4. The hypothesis of pangenesis involves several untenable subsidiary hypotheses.

Professor Delphino, the justice of whose attack is largely admitted by Darwin [illegible] eight subordinate hyopotheses which are required by the theory and [illegible] which are not tenable.—(See "Sientific Opinion," Sept. 29th, 1869, p. [illegible] St. George-Mivart, "Genesis of Species," chap. x.)

[illegible]mules must [illegible] the power in certain cases of producing mon-

atrocities; that is, your elective affinities must be capable of being thrown out of their grooves occasionally.

The theory does not account for the fact that sometimes certain gemmules, although nourished like other gemmules, do not develop. A generation passes and the traits of the parents are not in it. In the third generation come down the traits of the grandparents. Why did the gemmules lie dormant so long.

The hypothesis does not explain the inherited effects of the use and disuse of particular organs. "A horse," says Darwin himself, "is trained to certain paces and the colt inherits similar movements." Nothing in the whole circuit of physiology is more wonderful. How can the use or disuse of a particular limb or of the brain affect a small aggregate of reproductive cell in such a manner that the being developed from them inherits the characters of either one or both parents? Even an imperfect answer to this question would be satisfactory."—("Animals and Plants under Domestication," Vol. II, chap. x, Am. ed., p. 367.)

5. The theory of pangenesis explains everything by the elective affinities of gemmules for each other; but leaves these elective affinities themselves unexplained.

6. According to Darwin's own concessions, many facts in hereditary descent are wholly inexplicable by his hypothesis; and his theory, "from presenting so many vulnerable points, is always in jeopardy."

7. The hypothesis is rejected by the foremost authorities in the microscopical investigation of living tissues.

8. The theory is not needed, as all the facts it is used to explain are accounted for by defining life as the power which co-ordinates the movements of germinal matter; and by assuming, what all the facts prove, that this power is transmitted in hereditary descent.

XV.

DARWIN ON THE ORIGIN OF CONSCIENCE.

It has been well said that the question as to the origin of conscience has the same relation to modern philosophical discussion of religious truths that Bœotia had to the geography of Greece. That province was the key to the whole land. It became, consequently, the very dancing-plot of Mars. We have had many a theory put to such straits in explaining the single syllable *ought* as to assert with Bentham that, "if the use of the word is admissible at all, it ought to be banished from the vocabulary of morals."—("Deontology," I., p. 32. The distinction between the desirable and the dutiful is a fact, however. The desirable is merely the optional; the dutiful is the imperative. The most characteristic element in the latter can never be explained solely by the former. The theories which derive the dutiful from the desirable have in all ages had insuperable difficulties in discovering a basis for moral obligation. The upholders of utilitarianism have to this hour reached no real unanimity on this central point. Bentham went so far as to deny the existence of duty. "It is, in fact, very idle to talk about duties. The word itself has in it something disagreeable and repulsive."—(*Ibid*, p. 10). The angular, sharp, erratic Shopenhauer suggests that conscience is composed of five elements,—fear of man, superstition, prejudice, vanity, and custom.—("*Grand Probleme der Ethik*," p. 196). Even David Hume, however, could say that "those who have denied the reality of moral distinctions are to be ranked among the disingenuous disputants; nor is it conceivable that any human creature could ever seriously believe that all characters and actions were alike entitled to the affection and regard of every one."—("Inquiry Concerning the Principles of Morals," Essays, Vol. II., p. 223). Profit, a man may disdain; but duty has a commanding presence. We can refuse to do our duty; but we are unable to deny its authority over us in right. *De jure* conscience always rules, although *de facto* it may not. All languages recognize the distinction between profit and duty, the desirable and the dutiful, mere expediency and the right. These great phenomena in language have their natural causes as much as anything in a fossil. They are facts. They are hard, unmistakable, enduring circumstances in human experience. The question as to the origin of conscience is not only a vastly more important one than the inquiry concerning the origin of species,

but it is one that can be investigated by the scientific method almost as readily. I enter on the dancing-plot of Mars here for the first time. Many of you may have thought, as some public writers do, that I have dodged this topic. I have postponed it, in order that I might bear the whole brunt of its onset, after discussing the moral sense in detail. Having shown what conscience is, I now, with some profit, I hope, may raise the question: How did it originate?

If you are satisfied that Darwin's hypothesis of hereditary descent, or pangenesis, requires in the gemmules innate powers or affinities that amount to as great a mystery as what we call life, then you will be convinced at the outset that conscience must have been involved in the original capacities of that first living matter out of which, according to your theory, all animal forms have been evolved. If you are an evolutionist of the extreme type, I will not say of the extremest or materialistic sort, you may yet hold that conscience is in the constitution drawn up in the cabin of the "Mayflower," before the ship landed; and I, for one, shall have no great quarrel with you if that is the form of your evolutionistic philosophy. But Darwin has put forth a special theory of conscience. He has endeavored to show how the moral sense, as it exists in man, may have been developed exclusively from the faculties possessed by animals. He makes conscience only another name for the operation of the social instincts conjoined with the intellectual powers.

Whenever an instinct is not satisfied, a feeling of unrest arises. If, for instance, the desire for food is not satisfied, we are left in unrest. Every instinct has a pleasure connected with its gratification, and a pain in the absence of its proper food. Just so the social instincts have pain behind them, when they are not gratified. Darwin's central proposition in his discussion of the moral sense ("Descent of Man," Vol. I. chap. 3) is that he thinks it "in a high degree probable that any animal whatever, endowed with well marked social instincts, would inevitably acquire a moral sense or conscience, as soon as its intellectual powers had become as well developed, or nearly as well developed, as in man." Thus Darwin derives conscience from the combined operation of the social instincts and the intellectual faculties. He makes remorse of conscience to be only the feeling of dissatisfaction a man has when the social instincts are not satisfied. He would have us explain the feeling that we are to blame by the fact that we are not satisfied in our social instincts.

What are some of the more important objections to Darwin's theory of the origin of conscience?

1. Darwin teaches that "man comes to feel, through habit, that it is best for him to obey his more persistent instincts." But, in the same connection, he affirms that "the wish for another man's property is, perhaps, as persistent a desire as any that can be named."—("Descent of Man," Am. ed., Vol. I, pp. 88 and 89.) Two pages before the first of these sentences I find the second one. The context shows that instinct and desire are used here as synonyms. To convince yourself of this, read ten pages in Darwin's famous chapter on the moral sense. Theft and robbery, therefore, if we are to be logical, are to be

justified on the basis of Darwin's theory that to follow conscience is to obey our more persistent instincts. As Professor Calderwood, of Edinburgh University, has said: "Neither a good morality nor a doctrine of personal obligation can rest on this basis."—("Hand-book of Moral Philosophy," p. 147.)

The strength of an instinct depends on two things—the persistency of the desire it represents, and the vividness with which we recall the pains or pleasure arising from the desire. Hunger, for instance, is an imperative desire; but when satisfied its pains cannot easily be recalled in memory. It has often been remarked that our painful sensations are reproduced in imagination less easily than our pleasurable. Now, this desire for another man's property, Darwin affirms, has in unsurpassed fulness the first part of strength—namely, the persistence of the desire. "It is," he says, "perhaps as persistent a desire as any that can be named." But there is another part of its strength, and that is the vividness with which we can recall the pains or pleasures arising from it. Darwin affirms concerning that part of its power only that "the satisfaction of actual possession is *generally* a weaker feeling than the desire of possession." He thus implicitly admits that sometimes it is not a weaker feeling than the desire. Well, then, if *sometimes* it is not a weaker feeling than the desire, of course, both parts of the strength sometimes belong to this impulse. If, therefore, the most persistent and strong instinct *ought* to be followed, as Darwin says, then sometimes our desire for another man's property ought to be followed. Darwin explicitly teaches that man comes to feel, through acquired and perhaps inherited habit, that it is best for him to obey his persistent instincts. "*The imperious word 'ought' seems merely to imply the consciousness of the existence of a persistent instinct.* We hardly use the word *ought* in a metaphorical sense when we say hounds ought to hunt, pointers ought to point, and retrievers ought to retrieve their game."—(*Ibid.* p. 88.)

Here, therefore, is an instructive example of a lack of metaphysical and philosophical training in a renowned naturalist. Again and again this fallacy has been pointed out. It is not brought forward here to-day for the first time. Many discussions have exhibited just this strange bewilderment in Darwin's reasoning. Undoubtedly this writer is an expert in observation. Darwin has a massive head in what the books call the observing faculties, but not a very massive one in the philosophical faculties. I am using for the brain only that outline chart which Professor Ferrier's latest researches seem to justify. Darwin's books, however, are the best map of his own spirit—perfectly honest, candid as the noon, a mass of facts which are a mine for this whole generation and for all generations to come within the field of biological research, and yet not remarkable for the philosophical traits prominent in the writings of a Hamilton, a Kant, or an Aristotle.

Read Von Hartmann's late criticisms on "The True and the False in Darwinism."—(*Journal of Speculative Philosophy*, October, 1877, and January, 1878.) You would have the very latest light, and so let me ask you to take Boston as a guide. And what part of Boston? Why, every man here is a

philosopher. The other day I went into a renowned establishment for the shortening of the hair. The barber said to me, during my visit three months ago: "Do you know that Hartmann is to publish soon, in a philosophical magazine in St. Louis, an article on the defects of Darwinism?" "No," said I, and stared to find that information at the street-corner in Boston. But I remembered that I was in Boston, and so excused my ignorance; for every one here is expected to know whatever goes on in all the four zones. A detailed conversation followed concerning Kant and Hegel. Last week I called again upon my philosophical friend, and told him I had looked into the *Journal of Speculative Philosophy*, published in St. Louis, and seen the article in the last number. "Yes," said he, "but it is a second one." I consoled myself by reflecting that, even if the mayor of Boston had ceased to speak Latin, my friend of the razor in that city knows all the freshest philosophical news.

Read Verchow's recent reply to Hackel:

"Only ten years ago, when a skull was found perhaps in peat or in lake dwellings, or in some old cave, it was believed that wonderful marks of a wild and quite undeveloped state were seen in it. Indeed, we were then scenting monkey air. But this has died out more and more. The old troglodytes, lake inhabitants, and peat people, turn out to be quite a respectable society. They have heads of such a size that many a person living would feel happy to possess one like them. . . . On the whole, we must really acknowledge that all fossil type of a lower human development is absolutely wanting. Indeed, if we take the total of all fossil men that have been found hitherto, and compare them with what the present offers, then we can maintain with certainty that among the present generation there is a much larger number of relatively low-type individuals than among the fossils hitherto known. . . . . As a fact, we must positively acknowledge that there is always a sharp limit between man and the ape. *We cannot teach, we cannot designate it as a revelation of science that man descends from the ape or from any other animal.*"—(*Nature*, Dec. 6th, 1877, pp. 112, 113.)

If you will allow me to affirm that Darwin teaches, at the outset of his discussion of the moral sense, propositions that would undermine the whole doctrine of personal obligation, I shall have said enough to make you cautious in adopting that theory of the origin of conscience.

2. In Darwin's attempt to trace the development of conscience from purely animal instincts, ideas of morality drawn from other sources slip into the argument.—(See this criticism developed in Newman Smyth's "Religious Feeling," and in St. George Mivart's "Genesis of Species," and in various other writers.)

The atmosphere in which he conducts his experiment is full of germs of the moral sense. It has been well said that they who try to prove spontaneous generation to be a fact usually perform their experiments in an atmosphere saturated with the germs which they wish to develop.

Darwin calls to his aid, in explaining the origin of the moral sense, a great number of floating moral germs. I have singled out twelve of these, and hardly need do more than name them in his language.

(1.) "Highly developed mental faculties." That word *mental* is very vague. If by mind you mean the whole spiritual equipment of man, as you sometimes do, it includes moral perception; and so surreptitiously, or, at least, unobserved, comes in the very idea of which Darwin would explain the origin.

(2.) "The feeling of dissatisfaction." That is another vague phrase. It might mean moral dissatisfaction.

(3.) "The power of language."

(4.) "The idea of the good of the community." A very vague phrase, that never would pass without being challenged under the microscope of metaphysical research.

(5.) "The power of public opinion."

(6.) "Obedience to the wishes and judgments of the community."

(7.) "Feelings of love and sympathy." These often mean much more than merely social instincts.

(8). "Power of self command." Of course, there inheres in the very idea of self-command the idea of a distinction between motives. A clear choice among motives involves moral perception of the different character of motives, as good and bad. And so, under that phrase, "power of self-command," may easily come in the very idea of which the origin is to be explained.

(9.) "Appreciation of the justice of the judgments of his fellow-men." There Darwin has the great word justice; but all languages recognize a distinction between the just and the merely expedient. A perception of what is just in motives is an act of conscience. Darwin allows this atmospheric germ to drift into his experiment. Appreciation of justice! Why, that is conscience, and that is the very thing you are about to develop here by spontaneous generation.

(10.) "Appreciation of justice, independently of any pleasure or pain felt at the moment." All these phrases are Darwin's. This last is not a poor description of one of the fundamental activities of conscience. Justice cannot be perceived at all without the power of perceiving the difference between right and wrong; and to perceive that, without any regard to the pleasure or pain felt at the moment, is the key of what we call conscience.

(11.) "Avoidance of the reprobation of the one or many gods" in whom the individual believes. Why, the sense of the divine comes to us from conscience, and that germ is more dangerous than any of the ten that have preceded it; but here comes one yet more dangerous.

(12.) "The fear of divine punishment."

Well, now, if you will give me all these germs, if you will let them drift into my bottle in which I am required to produce by spontaneous generation conscience, I shall have no trouble with that experiment.

These are phrases out of Darwin's famous chapter. You are to look them up for yourselves, and, if you are not thrown into scientific unrest as to Darwin's theory by such an amount of carelessness in his experiment, I shall say that you are accustomed to a loose application of the scientific method, worse than I have been taught, under even the mediæval and mossy instruction of Andover.

3. *What ancestors do not possess offspring cannot inherit.*

4. *The moral sense, therefore, cannot be inherited from a non-moral source.*

From my point of view, these two propositions are the most important in the whole range of investigation as to the origin of conscience. Our only safety in reasoning is to begin always with absolutely undeniable propositions, and then to make only such inferences from them as are axiomatically clear. I think these two propositions are clear; and from them may be made inferences that undermine the foundations of every merely derivative theory of the origin of the moral sense. Darwin's hypothesis assumes that the moral sense is inherited from a non-moral source. His scheme of thought, therefore, makes the stream rise higher than its fountain, or involves the assertion that there can be an event without a sufficient cause.

Mix gunpowder and fire, and the result will be an explosion. Therefore, a careless observer might say that the explosion was in the gunpowder and the fire. This is not the case, however. A third and viewless element, the air, combines with the gunpowder in the explosion and is necessary to its explanation.

Mix the social instincts and the intellectual faculties, says Darwin, and the result will be conscience. Therefore, a careless observer might say conscience was in the social instincts and the intellectual faculties. This is not the case, however. A third and a viewless element, the moral law, or the nature of things in their moral relations, combines its activity with that of the social faculties and the intellect, and must be taken into view in every explanation of conscience.

According to Darwin's theory, pain comes to conscience only when some persistent instinct is left unsatisfied, and, therefore, the essence of all conscientious action is simply the pleasurable. In natures badly organized the vicious is often demanded by the most persistent instincts. The vicious, therefore, in these natures is the conscientious in Darwin's sense; but this reduces the theory to absurdity.

6. It follows from Darwin's definition that the pleasurable, on the whole, is that which conscience justifies. Darwin's theory makes no adequate distinction between the pleasurable, which is only the optional, and the dutiful, which is always the imperative. It does not explain the commanding force of the word ought. It does not account for the axiom *Fiat justitia ruat cœlum*—let justice be done though the heavens fall.

7. Darwin himself concedes that his chief source of doubt with respect to his own theory of conscience is that senseless customs, superstitions, and tastes —such as the horror of the Hindu for unclean food—ought, on his principle, to be transmitted and they are not.

One rule of science is to look in the misty places which a theory will not explain for new light. Wherever there are unexplored remainders, we are likely to find new truths. Now, Darwin confesses that this vast range of senseless customs, superstitions, and tastes is not under the law of inheritance, and ought to be, if his theory is correct. What if a man has been made so much better than a clod that a good angel, stepping on him, leaves an imprint that is

not easily washed out; and a bad angel, leaving a bad imprint there, soon finds that the plan of human nature has reacted against the impression thus made, and that a sense of justice has wiped out, as with a sweeping billow, the track of his hoof, and left the shore clean as God made it? You would judge in that case that the shape of the shore has been determined by some other power than the impact either of good feet or of split hoofs. There is a plan in the sands. They are not sands; they are a soul.

XVI.

HERBERT SPENCER ON HEREDITARY DESCENT.

WHEN the ice breaks up in the St Lawrence, in the spring, it does not move all at once, but is first honeycombed by the approach of the sun from the south. In the middle of the mighty river an opening appears, where the currents are swiftest; and little by little they shoulder the masses of ice against the shore, piling them sometimes to the height of thirty and forty feet, with a noise of crushing, upon each other. At last the river carries to the ocean not a sheet of haughty solidified water, but of obedient aqueous fluid, reduced to pliability, moving with the swiftest currents, forgetting that it was ever locked up by the winter, and received into the sea as a part of the shouldering currents themselves. Just so that ice which has covered the surface of a large part of philosophy—that uncertainty as to the authority of self-evident truth, that frigid sheet of speculation which has asserted that conscience might have been another thing had our environment been different—is breaking up. It is being shot through and through by the returning vernal season of confidence in the plan of human nature. The central currents are already in sight. They begin to shoulder the edges of ice. Occasionally a great roar is heard along the banks. The crushing of the blocks has begun. And by and by we shall have this philosophy of nescience and materialism, this doubt whether there are any ultimate grounds of certainty, this skepticism concerning the inmost plan of man, melted, running with the great currents, received into the ocean at last, and casting up its gleaming and its exhalation into the face of the sky, with all the tides that God draws upward in the sea.

I am not prophesying in vain, for I hold in my hands the proof that the prophecy is being fulfilled. Stuart Mill and Dr. McCosh were accustomed to walk over this field of ice; and I must show you, before I advance to the physiological side of their problem, how unwilling Mill was to bear his weight on the central ice. He would walk near the shore with a very firm tread; but, toward the end of his career, Mill, in his "Examination of Sir William Hamilton's Philosophy," said: "Whether the three so-called fundamental laws of thought are laws of our thoughts by the native structure of the mind, or merely because we perceive them to be universally true of observed phenomena, I will not positively decide; but they are laws of our thoughts now and invincibly so. They may or may not be capable of alteration by experience."—(Mill's "Admis-

sions." See McCosh, "Fundamental Truth," p. 75.) He is very shy of that ice. He knew it was getting thin.

Many think Mill asserts that all our fundamental beliefs are the results of our environment, and might have been different had our experience been different; but that is a great misapprehension. He says here, distinctly, that the more important of them may or may not be capable of alteration by experience; and that is all he ever would say. If you will read the chapter in McCosh's "Defence of Fundamental truth," entitled "Mr. Mill's admissions," you will find twenty-four of these singular concessions, used as scimetars to cut down the haughtiness of the old and now largely outgrown associational philosophy.

But there was one point of the ice where the water came through. Mill would not weigh himself there. He would not trust the weight of a feather there. An elaborately unscholarly newspaper has lately called on me to prove that Mill ever said that any necessary belief—as, for instance, that a thing cannot be and not be at the same time and in the same sense—may be primordial or orginal in human nature and not the result of mere experience. I have been asked to give the page and line of Mill's writings where he uses this language. Now, if anybody will open the American edition of Mill's Examination of Sir William Hamiltion's Philosophy," at the eighty-eighth page of the first volume, he will read:

"That the same thing should at once be and not be—that identically the same statement should be both true and false—is not inconceivable to us, but we cannot conceive that it could be made conceivable. We cannot attach sufficient meaning to the proposition to be able to represent to ourselves supposition of a different experience on this matter. We cannot, therefore, entertain the question whether the incompatibility is in the original structure of our minds or is only put there by our experience. The case is otherwise in all the other examples of inconceivability. Our incapacity of conceiving the same thing as A and not A *may be primordial;* but our inability to conceive A without B is because A, by experience or teaching, has become inseparably associated with some mental representation which includes the negation of C. Thus all inconceivabilities may be reduced to inseparable association, combined with the *original inconceivability of* a direct contradiction." —(See also pp. 96, 111, 112; and Mill's "Logic," Book 1, chap. vii., sec. 7.)

Mill, in his later career, never would put his foot over this place where the ice of the St. Lawrence was so thin. But we have men in Boston who go in there for a bath.

How shall we account for the unlikenesses of different organisms?

There are five theories for the explanation of the origin of the diversity of form in animals and plants and all that has life. Turning from the metaphysical side of the question as to the origin of necessary beliefs, I now am to outline before you the principal theories on the physiological side of that problem in philosophy.

Hereditary descent has been explained by one or the other of these hypotheses:

1. Chemical affinities.

2. Elective affinities.

3. Organic polarites.

4. Inherent movements in bioplasm.

5. Life, defined as the power which co-ordinates the movements of germinal matter.

We have, in the first place, the old Lucretian hypothesis, or atomic theory that chemical affinities and physical forces explain the origin of form in organisms. In the name of Herbert Spencer himself, we may make short work with that style of materialism. Agassiz used to say that, if only physical and chemical forces are at work in the organisms of plants and animals, we cannot account for the diversity of the types of growth. The chemical units are the same throughout the world. Oxygen is oxygen in the elm and in the palm, in the eagle and in the lion. Hydrogen, carbon, as ultimate atoms, are the same throughout the world, and, for all we know, throughout the universe; and, therefore, there is no accounting for the diversity of form in organizations, if physical forces are the only ones at work in them. The old Lucretian hypothesis is so far answered that it needs no longer to be considered in the conflict with materialism. It is not only crass and obsolescent, but among scholars it is obsolete. Let Herbert Spencer, however, be the policeman to give it the last quieting imprisonment. "It cannot be," says Spencer, in his "Biology," a book now outgrown by the progress of knowledge—"it cannot be," says Spencer, in 1866, "in those proximate chemical compounds composing organic bodies that specific polarity dwells. It cannot be that the atoms of albumen, or fibrine, or gelatine, or the hypothetical protein substance possess this power of aggregating into specific shapes"—and he gives the same reason upon which Agassiz insisted —"for in such case there would be nothing to account for the unlikeness of different organisms. Millions of species of plants and animals, more or less contrasted in their structures, are all mainly built up of these complex atoms. But if the polarities of these atoms determined the forms of the organisms they composed, the occurence of such endlessly varied forms would be inexplicable. Hence, what we may call the chemical units are clearly not the possessors of this property." —("Biology," Am Ed., Vol. 1, p. 182.)

Many a man who calls himself a Spencerian, but is only a random student of his writings, or who has read him with his fingers, more than with his eyes, and heard him with his elbows rather than his ears, will defend on the street, and sometimes in the newspapers, that obsolescent form of materialism which even Spencer discards. I shall from this point on take it for granted that the Lucretian hypothesis of materialism is dead.

Next we come to Darwin's theory of elective affinities, or pangenesis. Allow me to recal the facts which were put before you the other day concerning the complexity of these affinities. We have here a circle, let us suppose, and at its centre there is an atom of matter. According to Darwin's hypothesis, all the movements of matter in living organisms are to be accounted for by the elective affinities of minute particles, called gemmules. Darwin does not in

terms deny that the first germs were originated by the Divine power; but it is not necessary for him to do that. Such affinities were put into that original germ that everything we call life has been developed out of the germ. We, therefore, must determine the qualities of that original living matter by Darwin's definition of elective affinities. Now, how many affinities must there be to account for the movements of a particle of matter to any and every point of a circle drawn around it? Why, just as many affinities as there are points in the circle! You have 360 degrees in your circle, and there are at least 360 points measurable by the microscope in each degree. If the affinities of this gemmule account for all its movements, they must account for its movements in any direction, toward any part of that circle. In constructing the complex whole we call man the gemmules must move to every part of a circle—up, down, forward, backward. Indeed, we must not only have affinities that will enable the atom to move in every direction inside a circle, but in every direction inside a sphere. I have represented here only a plane surface; but if there were another circle cutting thus at right angles (drawing a figure on the blackboard), the atom would need to have as many affinities as are represented by the radii of both the first and the second circle. Inside a sphere there must be as many affinities as there are points toward which that central particle will be called or tend in its weaving different physical tissues. Rather a complex set of affinities to belong to one gemmule; and yet Darwin's affinities must thus be complex, or they cannot account for the formation of what we see, what we can touch. Gemmules must be moving in all directions, or they cannot build a hand or an eye. Thus we see that as many dots as can be placed on the inside of a sphere by the aid of the best microscope will not be as numerous as the affinities that must belong to every gemmule, if you are to account for its motion.

But motion is not the only thing for which Darwin must account. He must explain the self-nourishment of each of these gemmules. They must have, therefore, as many affinities as there are different kinds of tissues in the organism to which they belong. One gemmule here must take up the matter necessary to produce a cellular integument, and another here that which is needed to produce a lens in the eye, and here for bone, and here for muscle, and so on through the multitudinous forms of tissue. Thus, while we have need of a host of affinities to account for motion, there must be a second infinitude of affinities to account for self-nourishment.

But self-nourishment is not the only thing to be explained by elective affinities. Growth and formative power must be accounted for, and these in every different type of organism must be peculiar. Here, then, a third and fourth infinitude of affinities are needed.

But we must also account for reproduction. We must also account for the co-ordination of tissue with tissue. So here are six kinds of incalculably complex labyrinths through which these affinities must wander, without error or bewilderment. Draw circles around each of the other sets of affinities, as you did around the first set, and you will find them just as complex. There must

be sphere within sphere; and every one of these affinities must be accounted for by the qualities possessed by the atoms of the original germ from which all life has descended. The affinities must work, wheel within wheel, endlessly; and at last they must bring out a type of being that is a unit, always one thing from birth to death. Destroy the co-ordinating class of affinities, and the others would explain nothing. We reach here, therefore, the necessity of a co-ordinating power.

Professor Delphino, of Florence, looking with his keen Italian eye upon Darwin's hypothesis of pangenesis, said, as many scholars have affirmed since, that it requires eight subsidiary hypotheses. But not eight only—eight hundred, rather, are required. There must be these different offices performed by every living thing, and the movement of the gemmules must be accounted for by affinities practically infinite in number. Nevertheless, when we examine the necessities of Darwin's hypothesis of pangenesis, we must include among the affinities of the gemmules a co-ordinating power as effective as what we call life. There must be some power that holds all these gemmules to one plan in their weaving. There is such a power. We know this. Darwin does not deny the existence of this co-ordinating power; but he calls it affinity. It is elective choice among these gemmules. Since, therefore, the existence of a co-ordinating power is conceded, let us fasten the fact in our memory. Darwin meets us at this co-ordinating power which governs the movements of germinal matter. We call it life. He calls it an elective affinity. I undertake to assert that there can be no clear statement of Darwin's hypothesis of pangenesis that does not include this co-ordinating power behind the movements of germinal matter. In the facts it acknowledges, the second of the five theories, therefore, is not very unlike to the fifth.

Turning to the third hypothesis, we find Herbert Spencer's famous doctrine of organic polarities. This is not Darwin's theory by any means, although the latter is often confused with it. In his definitions Herbert Spencer is famous for his felicity of phrases; but not for felicity of thought. Organic polarity is the smooth phrase he uses to describe the cause of unlikeness in organisms. How does he himself define these two words?

Herbert Spencer is a candid man, under the power of a tyrannical theory. His effort is to account for everything in life by matter and motion. He would express everything in what we call vitality in terms of matter and force. When, however, he gives a definition of what he means by polarity, the facts of actual observation trouble him. He says that there is "an *innate* tendency in living particles to arrange themselves into the shape of the organism to which they belong. . . . For this property there is no fit term. If we accept the word polarity"—I am reading here a chapter entitled "Waste and Repair," in Spencer's "Biology" (American edition, p. 180–188)—"as a name for the force by which inorganic units are aggregated into a form peculiar to them, we may apply this word to the analogous force displayed by organic units; . . . . taking care, however, to restrict its meaning."

Hundreds of loose readers of Spencer think he means by "polarity" just what is meant by it in the range of physical research. He carefully restricts the meaning of the word, and closes his paragraph by this very significant language: "If we simply substitute the term polarity for the circuitous expression *the power which certain units have of arranging themselves into a special form*. Well, that is substantially what we mean by a *co-ordinating power behind the movements of germinal matter*. Any man who will attend to definitions—and I have nothing to do but to attend to them—may easily ascertain that the power that Herbert Spencer calls organic polarity must be, at the last analysis, substantially the same in effect as life, defined as the power which co-ordinates the movements of germinal matter. Come out upon this sheet of ice to the central currents, and you will find Herbert Spencer just as shy, in the range of physiology, as Stuart Mill was, in the range of metaphysics, of putting his foot on that central ice. The trouble is that some of you have wandered with Herbert Spencer only up and down the shores, looking at the bank-swallows' nests there, full of snow.

Herbert Spencer himself more than hints that life must go before organization, although in spirit his theory has little regard for that truth. "It may be argued that, on the hypothesis of evolution, life necessarily comes before organization. On this hypothesis organic matter in a state of homogeneous aggregation must precede organic matter in a state of heterogeneous aggregation. But, since the passing from a structureless state to a structured state is itself a vital process, it follows that vital activity must have existed while there was yet no structure. Structure could not else arise."—("Biology," Am. ed., p. 167).

The cause must go before the effect. Structured matter is structured by a cause. That cause goes before the structure it produces. The structuring cause Spencer calls organic polarity. We call it life. As far as it makes use of facts, the third theory is, therefore, at the last analysis, substantially the same as the fifth.

In the advance of microscopical investigation we are finding that the great discoveries of the last thirty years concerning germinal matter have forced, even upon materialistic biologists, since Spencer wrote his work, a new definition of life, and one approaching yet more closely to that which has been defended here. The latter may be called the established definition. I call it the Aristotelian also, for it expresses Aristotle's idea that life is the cause of forms in organisms. I hold in my hands a recent work representing fresh discussion by French materialists. The book has but just crossed the ocean. It is "Biology," by Dr. Charles Letourneau—a work well known in French and translated now into English by Maccall, and constituting the second volume of Chapman & Hall's Library of Contemporary Science. Its discussion has a materialistic trend, as any one will see who opens at the strategic points. Always, when you take up a book on biology, turn to the chapter on spontaneous generation. If any man believes in spontaneous generation, he is behind the times. But Letourneau writes, not without courage:

"We are compelled to admit that the first living beings spontaneously organized themselves at the expense of mineral matter.

"The Darwinian doctrine, which results with such evidence from palæontology, from embryology, from the well hierarchized classification of the organisms, demands as its indispensable complement spontaneous formation, without germs, without parents, of the first examples of the living world.

"In the scientific domain, any logical and necessary deduction or induction ought to be admitted without contest, though it may shock old ideas and shatter old dogmas." —(P.301.)

Here is much more audacity than acuteness. In contradiction to Darwin, and against Tyndall, against Huxley, against all the cautious men in our modern physical research, this representative of Hackel's school asserts spontaneous generation. He is to be pitied, but needs no reply here.

Nevertheless, when I turn to Letourneau's definition of life—this is the second strategic point in any book on biology. Feel the pulse at these two places in any volume on which you cannot spend more than ten minutes—I find Herbert Spencer's definition rejected, in the name of late research:

"The definition of H. Spencer—'The continual agreement between interior and exterior relations'—has the fault of being too abstract and of soaring so high above facts that it ceases to recall them. Besides, just by reason of its vague generality, it might also be applied to certain continuous chemical phenomena.

"It would be better to descend nearer to the earth, and to limit ourselves to giving a short summary of the principal vital facts which have been observed. Doubtless, life depends upon a twofold movement of decomposition and renovation, simultaneous and continuous; but this movement produces itself in the midst of substances having a physical state, and most frequently morphological state, quite peculiar to them. Finally this movement brings into play diverse functions in relation with this morphological state of the tissues habitually composed of cells and fibres endowed with special properties.

"Let us say, then, that 'life is a twofold movement of simultaneous and continual composition and decomposition, in the midst of plasmatic substances, or of figurate anatomical elements; which, under the influence of this indwelling movement, perform their functions in conformity to their structure.'"—P. 34.)

I consider this late definition an important piece of philosophical news, and it is my business here, as an outlook committee, to put before you all such intelligence on which I can lay hands. This French materialistic writer gives a definition of life very much nearer the one which has been defended here than any in Darwin or Spencer. He calls life, substantially, an internal movement in bioplasm.

Letourneau's definition is too long and has not the usual French grace of expression; but three things are very noticeable in it. First, life is defined as a movement occurring at its earliest stage "in the midst of plasmatic substances," by which he means bioplasm. Thus he confines life at its outset to germinal matter. Spencer's definition does not thus limit life. Second, Letourneau speaks of movements in "figurate anatomical elements" as life; but elsewhere recognizes the fact that these elements obtain their figurate character by the agency of bioplasm. Lastly, Letourneau's definition points out the existence of a co-ordinating force. The figurate elements and plasmatic substances "perform their functions in conformity to their structure."

Thus, in the progress of discovery, the latest definitions of life approach more and more nearly to the Aristotelian. At the last analysis, this French materialistic definition, which calls life "a movement in plasmatic substances," implies all that has been asserted here in the definition of life as the power which co-ordinates the movements of germinal matter. The movement in plasmatic substances must have a cause, and this we call life. Notice the gradual approach of science to that definition. The progress of microscopical research has forced materialism forward to this final breaking up of the ice. The Lucretian theory is ice on which no man dares to stand. Darwin's elective affinities and Spencer's organic polarities lie at spots where men already hear the ice break. In Letourneau's definition the swift central currents begin to pile the ice up on the shore. In Beale's, Lotze's, and Ulrici's, as well as Aristotle's definition, you have the clear, open stream.

What bearing has this definition on the question as to the origin of conscience? How far has the definition a practical application in reference to the authority of self-evident truth? See, there is a stack of books—I might have piled it half as high as the roof of this temple—turning on the inquiry whether conscience is really final authority, whether it results from the plan of our nature, or whether it might not have been different had our environment been different. On the physiological side here is another stack of books, that I might have piled half as high as the roof of this temple, and turning in large part upon the same question.

1. None of the five theories, except the fifth, accounts for man's sense of unity and identity.

2. The theory of life, therefore, is the only one that covers all the facts in the case.

3. Lionel Beale does not hesitate to say that "the vital power of the highest form of bioplasm in Nature is the living I."—("Bioplasm," p. 209, London, 1872).

4. Even Spencer and Darwin are obliged to use the word innate.

5. Since a structuring power must exist before anything can be structured, the plan of the body is innate in its co-ordinating or structuring power.

6. The plan of the soul, including its necessary beliefs and the conscience, is also.

7. There are, therefore, innate tendencies not derived from our environment; there are primary beliefs, intellectual and ethical and æsthetic, inhering in the plan of the soul.

8. The pretence that the conscience and the mathematical axioms are merely the inherited effects of environment and experience, and might have been different had experience been different, is thus answered.

The established definition of life as the power which co-ordinates the movements of germinal matter, proves that there was a plan in the cabin of the "Mayflower" before any sailors landed. In the original structure of the soul we find the origin of necessary beliefs, and the divine revelation of self-evident

truths. Conscience is a primordial power. Our necessary belief that there is a distinction between a whole and a part, and right and wrong motives, would not have been different had our environment been different. The progress of research, in justifying more and more the Aristotelian definition of life, causes at last the icy congealments of the river of philosophical speculation to break up. We shall need, twenty-five years hence, I think, no discussion with those who do not recognize in fundamental truths authority entirely beyond experience. "Primordial," as Mill says; "original," as French materialism says; "fundamental," as McCosh says; "innate," as Spencer says—the primordial, original, fundamental, innate, self-evident truths will be victorious when once the course of scientific discussion has shouldered the heavy masses of its ice into the middle of the stream. The correct scholarship of the world is a clear river there already; and on it—the swift, central, enduring current—I advise you to launch your fortunes.

XVII.

MARRIAGE AND HEREDITARY DESCENT.—I.

When there comes together at noon-time in a busy city a great audience, expecting only dry analytical discussions, it is complimented if the speaker begins with difficult matter. I am about to dicuss marriage in its relations to the laws of hereditary descent. The first question which the mystery of the arrival of a human being on this planet suggests is: When did its soul come into connection with its body? While we face that inquiry we stand in the holy of holies of modern research, and I shall not ask you to take as high priest there any American or English philosophy. I shall adhere to the rule of this lectureship, and give you what I suppose to be the best on the globe within range of our field of investigation, and not merely the best on this side the Straits of Dover.

Let me, therefore, outline rapidly before you Hermann Lotze's answer to the question: When does the soul unite with the body? The philosophy taught here is not that of Lionel Beale; nor that of Lotze exactly. I used Beale's facts very largely in biology; I used Lotze's philosophy more than any other. It is our duty to examine here many an authority on these great themes. I have not always proclaimed the fact when something novel has been presented on this platform. If you do not find everything elsewhere that you find here, why, you may conclude that I have not either. But to-day entering upon a very dangerous field of audacious speculation, I shall be representing Lotze's opinions, rather than my own.

1. From the idea of matter life and soul cannot be explained.

2. From the idea of spirit all material properties may be deduced.

3. Choose the latter as the ultimate substance of all things, and we satisfy the desire for a similarity of character in all that exists.

4. Physical phenomena point to an underlying being to which they belong, but do not determine whether that being is material or immaterial.

5. Matter is a form clothing a supersensible reality, in itself similar to the soul.

6. When matter acts upon soul, or is acted upon by soul, it is not necessary to suppose that it acts as matter through the physical forces of its external sheath, but that the supersensible basis or core of matter directly acts upon and is acted upon by the other supersensible reality, the soul.

7. The will, Lotze believes, can produce movements in matter; not without cause, but without cause of the same kind—that is, without a pre-existing movement whose energy is passed on into a new movement.

8. Consciousness is not a passive concomitant of the material changes in the nerves, as has recently been taught in Europe and America.

9. A difference of substratum transforms heat into magnetism, or electricity into heat.

10. If a physical energy is transmuted into a spiritual energy, it is absolutely necessary to suppose the presence of a peculiar subject, the soul, which by its peculiar nature produces this difference on the character of the phenomena.

11. Lotze's view, therefore is in complete harmony with the doctrine of the correlation and transformation of forces.

12. The birth of the soul is not the result of the natural course of things; nor yet is it a creation out of nothing.

13. The substance of which it is made existed in the exhaustless substance of the Absolute.

14. The extended world of phenomena is not distinct from the domain of the Absolute, or the spiritual world, whence the soul comes; but is penetrated everywhere by it.

15. "That condition of the natural course of things in which the germ of a physiological organism is developed is," says Lotze, "a condition which determines the substantial reason of the world to the production of a certain soul, *in the same way that an organic impression determines our soul to the production of a certain sensation.*

(Lotze, "*Medicinische Psychologie.*" See the translation of this work into French by M. Penjon, from a text so far revised and augmented by Lotze as to make the French better than the German edition as a final expression of Lotze's views. See also articles by Mr. Bixby in the *Unitarian Review* for February and March, 1877, with summaries, a part of the language of which, under a new arrangement, has been employed in this analysis. For other similar statements see Uberweg, "History of Philosophy," Vol. II, 312–321, and Erdmann, "*Grundriss der Geschichte der Philosophie.*" Vol. II, ch. 347, 11–18.)

Suppose that we have here [making use of the blackboard] two differently arranged sets of particles of matter. The union between one of these masses and the other occurs at this middle line. If we jar the particles on the left of that line and the motion of the atoms crosses the line, the motion will not be the same on the right as on the left. Why not? Because the particles are not arranged there as the particles are on the other side. Why is it important to notice that circumstance? We can transform heat into magnetism or magnetism into heat. Both are only modes of motion, or a shiver of the ultimate particles of matter. You have here in the left-hand figure a peculiar organization of matter; and there in the right-hand figure another organization. You find that heat passing from this form of matter is transmuted into magnetism in that form. The difference between the shiver of the ultimate particles here

and the shiver into which it is transformed there is accounted for by the different organization of the two sets of particles. Heat is not magnetism, and when the former is transformed into the latter the difference must have an adequate cause. The transformation is supposed to be due to the peculiar and different nature of the magnetic substratum. We know that this different substratum exists, for we see its effects. So, too, if a physical is transformed into a spiritual energy, it is undeniably necessary to assume the presence of a peculiar subject, the soul, which produces this difference in the character of the phenomena. The latter difference is one of almost measureless breadth, and so must the difference be between the soul and matter.

Lotze does not teach that the motions of the ultimate particles in the nerves are transmuted into thought and choice and will. That would be materialism. Neither does he teach that there are two parallel sets of phenomena, with no connection between them, and that the mystery of their union is absolutely inscrutable. That would be Herbert Spencer's nescience. Lotze assumes that matter and spirit have a common origin and, at the last analysis a common substratum. Matter to Lotze is visible force. In his view, it has all the ordinary qualities which we attribute to matter. It cannot move itself. Inertia is one of its inherent properties. Faraday was right when he said that inertia probably is the only true characteristic of matter. But at the bottom of all matter Lotze finds the Absolute Substance from which everything in the universe proceeds. All things finite were created. From what? From nothing? No. Is matter an effluence of the Divine Mind? In one sense, Yes. In one sense, No. God is not like matter; but matter is a product of the Omnipotent Will. The Divine Omnipresence transcends infinitely all matter and finite mind; but is immanent in both everywhere. Natural law is only the method of action of the will of him who was and is and is to come. This is true of the laws of matter, as well as of those of mind. Therefore, his will underlies the laws of matter—inertia, chemical attraction, cohesion, magnetic affinity—as surely as it underlies the laws of the soul. He has given a substance to the soul. He has given a substance to matter. The two substances, we say, are utterly unlike. There is one thing in which they are common. They had the same origin.

If, therefore, as one of the propositions I have put before you declares, we are to explain how matter can have an influence on mind, and mind have an influence on matter, perhaps we had better assume that the real core of matter is a supersensible reality. What does that long word mean? Something that cannot be reached by the senses. It is above our senses. There cannot be qualities in matter unless there is something in which the qualities inhere. The soul, too, has its qualities, and these must have something in which they inhere. That something is immaterial. But what we call immaterial in the soul and what we call supersensible in matter may have at the bottom one quality. When, therefore, the soul acts upon matter, or matter upon soul, it may be that the supersensible element in the one and the immaterial element in the other

are brought into contact. The likeness of the supersensible and the immaterial accounts for the influence of the one upon the other. It is not necessary to suppose that chemical affinities, regarded simply as such, are transmitted into thought. Lotze rejects, in the name of precision of thought, every form of the mechanical theory that leaves us to conclude that when the body is dissolved the soul is no more.

Must I venture an illustration to make these abstruse thoughts clear? There is a substratum in soul. There is a substratum in matter. When matter influences matter, the act is like that which occurs when two gloved hands meet and clasp. It is in one sense the gloves that clasp, and in another only the hands, the living forces beneath. But when matter, and a soul to which the Divine Will has given individuality, influence each other, we have a gloved hand—matter, meeting an ungloved hand—the soul. You say that the glove presses on the ungloved hand. What you mean is that the hand in the glove presses the hand that is without a glove.

This is Lotze's view, which I have been accused, in a Unitarian quarterly, I believe, of not understanding. Until to-day the progress of our discussions here has not called for a statement of it. I have not been pedantic enough to read page after page of German and translate it here; but, if you will look into Lotze's "Medical Psychology," in either its German or French form, by Penjon, you will find the propositions which I have put before you. Most of them have been published even in the *Unitarian Review*, by a writer who assails me for not understanding Lotze.

By the way, just at this point, perhaps I had better state that a few critics assume that, as to this lectureship, it thunders all around the sky. It does thunder all around the hurt Spencerian and Darwinian sky, and a little of that sky is sometimes found behind Orthodox mountain ranges. But I shall prove to you that I intend to mislead nobody. I shall offer some evidence that no attack has been made that is more than a Chinese thunder of gongs, instead of the real thunder from the sky. I shall prove to you my sincerity, at least, by asking you to read all the attacks! Study them elaborately. We are here as students. Nobody will be gladder to have faults pointed out than I. Nevertheless, I must assert, in the name of candour and straightforwardness, that the attack which seems to be made the bell-wether for all others is the one that I am the most anxious to have you read. If that attack is the best that can be made, there is no great risk to be run in defending a sound philosophy here. The writer founds an accusation of Pantheism upon a citation which expressly asserts the Divine Transcendency over all natural laws. As proof that it has been asserted here that "natural law and God are one," he quotes language which explicitly affirms that "He whom we dare not name transcends all natural laws"—that is, that God and natural law are not one. I have in my possession written proof that Agassiz made the same suggestion concerning parthenogenesis as that which was made here. Bishop Butler does not seem to this writer orthodox company. He has no words of respect for Beale or

Ulrici or Lotze. He underrates, very curiously, the great value in the conflict with materialism of the recent advances of knowledge in the field of microscopical research concerning living tissues. He overlooks entirely the distinction drawn here between life, vitality, and soul; and then proceeds to make injurious inferences consistent with this oversight. Not one important error of biological fact is pointed out. He cites discussions of a quarter of a century ago to justify the neglect of some of the most honoured results of German philosophy, based on new investigations of the last twenty years. I did not know, when I referred to this article the other day, in strong language, that it was attributed to an author of whom I have always spoken with studious respect. It is said that this attack was made by an "eminent naturalist." For my sake, I hope it was; for his sake, I hope it was not. From beginning to the end of his attack there is nothing inconsistent with one of the central propositions in it: "These lectures may be generally good, in spite of serious faults." The writer leaves open that way of escape. He keeps retreating lines well in sight. He has not asserted anything more than that sentence implies. Even in this way of episode, however, and by side blows with the left hand, I am not about to defend myself, for I need no defence from that attack, except that you should read it. I could put before you evidence here that every word this lectureship has indorsed concerning the downfall of Huxley's Bathybius as a biological celebrity is true. If any of you will study the original documents, you will be satisfied. Read Hackel's attempted defence of the Bathybius, in a late number of the *American Popular Science Monthly*, in which he admits that Huxley has changed his views, and that, from being a biological celebrity, Bathybius has tumbled down into the gloomy Hades of mythology. Even the crudely Spencerian New York *Nation* does not attempt to defend Bathybius. As to another point of partisan criticism, let me say that one of the foremost literary gentlemen in New England has authorized me, in writing, to assert that he knows the person who heard Thomas Carlyle make certain famous remarks cited here as to Darwin. Too much has been said in the *Popular Science Monthly* about the inaccuracy of the information obtained by Boston upon certain points; but Boston and Ruskin happen to agree as to these words of Carlyle. If I were at liberty to mention the name of the literary gentleman who authorized me in his letter thus to use his knowledge, I should convince you at once that on this point there has been here no speaking at random.

There will be partizan attack on this lectureship from all quarters of the sky. It means almost nothing, partisan praise or blame. Strong support and strong opposition will come. But the support from partizan sources means nothing to me; the attacks from partizan sources, almost nothing. But when a man, who has opposed all his life propositions which are dear to me—a man like the Plummer Professor of Harvard University—comes forward again and again and indorses the general discussion here; when a man like the revered ex-president of Harvard University, who has opposed all his life propositions

very dear to most of us, indorses this lectureship; when the Dean of Canterbury, and the *London Quarterly Review*, and the *Princeton Review*, and the *Bibliotheca Sacra*—I beg pardon, I am making a sad ado over nothing—come forward and support an experiment, a novelty, I think these, too, are signs of the times, and that in the sky behind the sky there is a little thunder also.

Lotze's doctrine is in perfect conformity with the modern theory of the conservation of force; and yet he never teaches that the motions of matter are transmuted into thought. Matter and spirit act upon each other through the supersensible reality which is in each. Lotze, of course, rejects what Hackel calls monism, or the hypothesis that there is but one substance in the universe with such properties that we can explain by it both matter and spirit. He distinguishes between the soul and the vital force. He affirms that the attempt to transform mental and moral science into a physical natural science is "mere manner of speaking, signifying nothing, or else is equivalent to the pretence of understanding by the eyes and seeing by the ears." He rejects the form of materialism defended by Professor Bain, and which asserts that matter is a double faced somewhat, having a spiritual and physical side.

The distinction between the philosophy of Lotze and that of Hackel and Bain is a subject worthy of the attention of all scholars, for the subtler forms of modern thought are crystallizing around Lotze and twenty other names which represent similar stages of investigation, and are departing more and more from Bain and Hackel. Audiences do not often in this country give the ear you have given in Boston to this discussion; and, therefore, here in Boston this audience is calling attention to these themes for the whole country.

Hackel's monism, which is one of the many forms of materialism, sinks soul in matter. Not so the subtler procedures of Lotze, not so Ulrici, not so Schoberlein. We have an accredited—I had almost said now firmly established—scheme of thought, recognizing the law contained in the fifteen propositions I have read to you, and asserting, in their name, the possible existence of the soul in separation from the body.

When does the soul originate? Lotze would not have you think of the immaterial world, the Unseen Holy beyond us, as separated from the visible universe. Souls, according to Lotze, do not come into the world from afar. They are not rained down out of some inaccessible region of the universe. They originate in God, who is not far from every one of us. He is omnipresent; and wherever he is there is the capability of creation.

Soul meets its organism wherever and whenever God calls that organism into existence. It is, according to Lotze, a being which, from its characteristic nature is in immediate relation with the co-ordinating centres of the nervous organism and with what goes on in them.

When God creates germinal matter, to be used as the basis of the career of an individual human life, he, out of the Omnipotent Power of the universe, brings into existence what we call the gloved hand, or bioplasm: then he locks with it an immaterial or ungloved hand which we call the soul. The two hands come into

being together. Lotze denies the theory of the pre-existence of the soul. But the ungloved hand does not depend for its existence on the gloved hand. We talk of matter as if it were a hand, and not a glove with a hand in it. So far as matter is inert, it is a glove only. This glove may be taken off. The supersensible reality at the core of it—the spirit—is God and is indestructible. That supersensible reality, the glove taken off, may lock in with the other hand, and thus the divine spirit and the soul, which the Spirit has created and upheld, the flesh dropped, the glove thrust away, exist forever locked together.

XVIII.

MARRIAGE AND HEREDITARY DESCENT.—II.

The ceiling of the Sistine Chapel at Rome contains a picture by Michael Angelo representing the creation of a soul. He had only these words to suggest the design of his painting: "Man became a living spirit." What would you have made had your task been to produce a picture with this sentence as its only suggestion? Angelo shows us Adam as a perfect body, reclining upon a mountain slope, and possessing animal life merely. The Supreme Spirit floating in ether, full of brightness, draws near him in human form. Of course, the figure representing the Divine Being must be a failure, and perhaps blasphemy, but, as a mere human form, art says it is one of the most matchless in the world. Some cherubs' faces that accompany it are exceedingly noble. This figure represents a Creative Power. It extends its right arm, and Adam lifts up his left. His hand is lax, his whole body is flaccid; but from the Divine finger to his finger there passes an electric spark of the Divine Likeness, and Adam becomes a living soul. A photograph of that supremely majestic work of Michael Angelo I keep on my study wall, and I cannot live with it out of sight. Nevertheless, to me it is not the most perfect symbol of the method of the Divine action in the creation of a human spirit. Better than that picture to suggest the attitude of modern science would be one far older—the tabernacle in the wilderness enswathed with a cloud full of light, and having at one part of its interior a holy flame. The cloud touching every part of the tabernacle is the emblem of the Divine Omnipotence acting in all natural law. But this presence is manifested in some parts of that tabernacle in a sense in which it is not in all parts. There is a conscience in man; there is in the human soul a capacity that does not exist in the immaterial portion of a brute creature. But the cloud enswathes the slabs and the brass and the curtains of the tabernacle, as well as the holy of holies. There is no portion of the symbol that is not bathed in the cloud; and so there is no part natural law that is not filled by the Divine Omnipresence. In the conscience, however, and in the creation of the human spirit, the Divine Presence is manifested as it is not elsewhere. At these places a holy of holies exists, and in it is a holy fire. On this theme, as on so many others, the meaning of the symbols of the tabernacle is inexhaustibly significant. The cherubim stand above that holy fire and look down upon what

lies beneath their wings, and do not understand it all. They know that spot is the holy of holies and that God is there; and probably ages hence, when illumination shall have filled the world, such as to make our present science darkness, the cherubims will yet fold their wings and say; "Holy! holy! holy! We know that God is there." Mechanism is not the word that will be written on that casket a hundred years hence. It is not the word written there to-day, under the eyes of the highest scholarship.

Instead of answering in the name of any authority—German, Scotch, English, or American—the question as to the origin of the soul, I am now to endeavour to obtain a reply from the established facts of biology. What do we understand of the process of the production of many lives from one? Stuart Mill asks us to make always a broad distinction between what we positively know and what is yet in debate. Leaving out of my list of propositions everything doubtful, I am now to collect and put before you only the facts as to which scholarship is agreed concerning the origin of the soul. Facts arranged in their natural order suggest their own explanation. While we listen only to facts which speak for themselves we are on firm ground.

1. Many of the physical organisms of the lower forms of life propagate themselves by self-division.

2. In a self divided organism there is in the two halves physical identity.

Suppose that we have here [drawing a figure on the blackboard] what Hackel calls a Moneron, one of the lowest types of life, an animal of irregular shape, a mass of protoplasm. It moves. It feeds itself. It grows. It has life. After it has grown to its natural size, it constricts itself in the middle [illustrating on the blackboard], and finally falls into two portions. Self-division like this is the simplest form of self-multiplication of organisms. There appears to be concerned here just that mysterious property which a living mass of bioplasm exhibits when we see it, under the microscope, throw out a promontory, which becomes detached at last, and then, as it takes up nutriment, goes on enlarging according to the law which governs its parent.

The supposition is that the mass of bioplasm is homogeneous, or of the same qualities throughout. The promontory it projects will be physically of the same qualities with the parent mass. When that promontory breaks off, there will be in the island the qualities it had as a promontory. Therefore, between the island the original mass there will be physical identity. So, when an organism, consisting of a homogeneous mass of bioplasm, multiplies itself by self-division, the original organism and the subdivided halves are related to each other by physical identity.

3. In a self-divided organism physical identity is transmitted by hereditary descent.

Here begins, but here by no means, as Haeckel thinks, ends the explanation of the law that like breeds alike. Two yet greater facts are equally demonstrable with the three already mentioned.

4. The co-ordinating powers governing the movements of the two halves are also identical.

5. The co-ordinating power is, therefore transmitted in hereditary descent.

In our subdivided organism here [referring to the blackboard] each half goes on acting as the parent did. Each takes up nutriment and enlarges, and finally divides, as did its parent. These movements must have a cause. The laws of the movements are identical with the laws of the original organism. The co-ordinating power which we have proved to lie behind all the movements of organisms we know, therefore, is transmitted here. Its effects are visibly the same here as they were there. The cycle of life through which that subdivided half passes is the same as that through which the parent passed. The co-ordinating power goes over. The physical power goes over.

6. Between the parent and the germ of the child there exists, therefore, a double identity—the one physical, and the other not physical; the one material, and the other not material.

7. On the basis of this double identity stands the supreme law of hereditary descent—that every organism breeds true to its kind.

It is vastly important that we should take these earliest steps with great caution and be sure of our ground at every point. We demonstrate by its effects that the co-ordinating power is transmitted in hereditary descent. We are sure, from all our previous arguments, that this co-ordinating power does not belong to matter. We have proved here, we think, that life in physical organisms is the power which co-ordinates the movements of germinal matter. That co-ordinating power existed as one life. Now it exists as two lives. So much is certain. You say that it has divided itself. Very well. Do not look into mysteries to-day. I do not know how one individual becomes two. The angels gaze on that casket, and do not understand what is within it. I am not pretending to illuminate mysteries. What we know beyond doubt is that in a self-divided organism one life becomes two lives. How one individual becomes two individuals I do not know. Nobody knows. We know *that* one does become two; but not *how* it does. When we examine facts, however, we can trace the action of this double identity, physical and immaterial. This undeniable circumstance explains much. Every organism breeds true to its kind, and it does so because a double identity exists in the parent to the child.

Self-multiplication by the division of organisms involves a production not only of two lives out of one, but of twenty, sometimes, out of one. You may take the water polyp [illustrating on the blackboard] and chop it through the middle, and each part will develop into a perfect animal. Chop each of these through the middle, and each half will develop into a perfect animal, and so on until you have produced from one individual, it is said, forty. Many biologists affirm that forty lives can be produced in that way from one in some lower organisms that are homogeneous throughout. Of course, if you take a bird from a bush or a twig from a tree, you cannot produce a whole organism from any one part; although, by the way, a twig from a tree as a scion may develop

into a growth like its parent. You must have one of the lower organisms homogeneous throughout in order to give to each segment the power of reproducting itself. How all that occurs nobody understands. If you wish me to speculate, I will say that the co-ordinating power goes over here and that physical identity exists here. The co-ordinating power in the homogeneous animal is found in every part, and when you divide and subdivide the organisms the co-ordinating power draws to itself from the outer world clothing in each of the fragments, as it drew to itself clothing in the whole animal originally. There are two kinds of ghosts—tangible and intangible. Every organism is a tangible ghost. I am no spiritualist. When I take as a guide a rat-hole revelation it will be when the clouds obscure the sun at noon. In the water polyp we have a co-ordinating power, and it is attracting to itself a clothing. We sub-divide the animal, and each part draws to itself similar clothing. We do not suppose that the co-ordinating power is increased or diminished. It was all in that original organism. It was all in the germ of that animal, and its forty lives have all been evolved from that original co-ordinating power. That is what we see. There are the facts. But how they were evolved is more than we know. It is a mystery, perhaps, beyond plummet's sounding.

8. The double identity between the parent and the germ of the child is the cause of the likeness of the latter to the former.

9. It is not physical sameness which accounts for the likeness, but the sameness of the co-ordinating power.

Many germs of different animals are chemically identical. The difference, therefore, in their development must be accounted for by the different co-ordinating powers behind them. It is, therefore, safe to assert, and it appears to me greatly important to emphasize the fact, that it is not a physical sameness which accounts for the likeness of parent to child; but the sameness of the transmitted co-ordinating power. The sameness of life is the influence which produces the likeness between parent and child, and not the sameness of the famous firm that Virchow of Berlin calls "Carbon Oxygen & Co."—a firm which, he thinks, has failed of late!

10. In the higher forms of self-multiplication, such as budding and egg-cells this law of double identity holds good.

Hackel says that all the laws of self-multiplication in its higher forms are involved substantially in the simple self-subdivision by which self-multiplication occurs in lower forms. We have organisms that multiply by budding and by seeds, and others by egg-cells; but at the last analysis there is a physical identity between parent and child, and an immaterial identity behind that physical identity. Hackel says that laws of hereditary descent may be summed up in the physical identity of parent and child. He holds that life is only a mechanical action of molecular particles. But we here have rejected his authority on that point. We hold that life is more than mechanical action. Hackel affirms ("History of Creation," Vol. I, p. 199, Am. Ed.) that "the life of every organic individual is nothing but a connected chain of very complicated material pheno-

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